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# MODELLING OF OZONE PRODUCTION IN THE SARNIA REGION

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Environment Ontario

Jim Bradley
Minister

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ISBN: 0-7729-5001-6

PIBS 513

# MODELLING OF OZONE PRODUCTION IN THE SARNIA REGION

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ARB-205-88

April 1989

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## 1. Introduction

Canadian guidelines for ozone specify that the maximum acceptable level is 82 ppb expressed as a one hour average. Ozone concentrations in Southern Ontario frequently exceed this level, and have been a cause of concern for a number of years. It has been established that the atmospheric ozone found in this region results from photochemical production from precursors emitted largely in the Sarnia-Windsor region, superimposed on ozone and/or precursors transported from south of the border (Yap et al., 1987). A field study was carried out in the Sarnia region in 1984 to help understand and quantify the problem (Lusis et al., 1985). The modelling study described in this report is complementary to that field work, and was designed principally to provide an indication as to which of hydrocarbon or $NO_x$ control would be more effective in controlling ozone production in this region.

A model incorporating simplified transport and dispersion, but sophisticated photochemistry was used in this work, and was run for a number of sets of initial conditions. These conditions were based partly on data obtained during the Sarnia Oxidant Study, with other conditions chosen to ensure that a broad, yet reasonable, range was covered.

## 2. The Ozone Simulation Model

### 2.1 Model Description

The model used in this work was a simple box model, incorporating sophisticated photochemistry. The chemical mechanism was developed for the Eulerian long range transport model, ADOM, developed for the Ontario Ministry of the Environment, the Atmospheric Environment Service of Environment Canada, and the West German Umwedbundesamt (ERT, 1984). This mechanism may be considered to represent the current state of the art. It has been extensively tested against smog chamber data. The model considers solely the chemical evolution of a specified initial condition, and does not include pollutant emissions or inflow through the boundaries of the model domain. In simulating any given day the modelled time runs from 10 a.m. to 4 p.m.

### 2.2 Model Validation

The model is highly simplified with respect to the real world, but its limitations were considered to be acceptable in the present study, since the results were only to be used in a relative sense. That is, the important conclusions from the model runs were the magnitude and direction of the changes in ozone concentration produced by changes in the initial conditions. Nevertheless, it was important to ensure that the model reflects reality sufficiently accurately that confidence can be placed in its predictions.

A number of the sets of initial conditions for which simulations were performed were based on measurements made during the Sarnia Oxidant

Study ("real" days; see Section 3). To test the model, its predictions for these days were compared with the maximum ozone concentrations determined on the same days. The results of this comparison are summarised in Table 1, and are presented graphically in Figure 1. The agreement must be considered to be excellent, particularly in light of the simplifications introduced in the model, and the fact that the spatial and temporal resolution of the measurements was not fine enough to ensure that the ozone maximum associated with the Sarnia plume was actually captured.

## 3. Initial Conditions

A comprehensive set of initial conditions was considered, based on measurements made during the Sarnia Oxidant Study (Lusis et al., 1985). Initially two specific days were selected, corresponding to relatively clean conditions, i.e. low ozone, $NO_x$ and organic compounds, (28 June 1984) and dirty conditions (3 July 1984). A number of perturbations were then applied to these conditions to test the sensitivity of the model predictions. The specific perturbations used were

- a doubling of the $NO_x$ concentration
- an increase of HC by a factor of five
- an increase of HC by a factor of 1.5
- successive reductions of NOx to 50, 28, 20 and 14%
- successive increases of NOx by 33 and 50%
- simultaneous increase of NOx and HC by 50%

In addition model runs were carried out for several other days from the Sarnia Oxidant Study for which reliable measurements were available. The specific days were 7, 8, 14, 16, 17 and 18 July. For 8 July two slightly different sets of initial conditions were used. Five further sets of conditions were then created, identified as A, B, C, D and E. Predicted ozone concentrations are presented in this report for all of these sets of initial conditions, and real day data were used to assess the performance of the model, as described in Section 2.2. However, considerations of the effects of precursor control were limited to the clean and dirty days, for which extensive perturbations of the initial conditions were applied.

The full set of initial conditions is summarised in Table 2. These conditions cover a wide range of concentrations of both $NO_x$ and organic compounds, as is shown in Figure 2. For the purposes of this figure the hydrocarbon concentration on a given day is summarised as

$$HC = 3*propane + 5*alkanes + 2*ethene + 4.5*alkenes + 7*aromatics$$

with units of ppbC. The numerical coefficients in the equation above (i.e., 3, 5, etc.) represent the number of carbon atoms in the given chemical. The coefficients are exact for propane and ethene, but are approximations to what might be found for a typical atmospheric mixture of the other groups. Note that this definition specifically excludes oxygen containing species. This

should not be taken to mean that such species are unimportant in the photochemical production of ozone; in fact they are known to be very important. It was simply chosen as a convenient representation for the concentrations of a number of chemical species. The headings in Table 2 serve either to identify the particular day modelled (e.g. Clean Day, A), or to describe how the conditions were derived (e.g. Dirty Day, f*HC indicates that these conditions were obtained by multiplying the dirty day hydrocarbon concentrations by a factor. The specific factors applied are given above).

## 4. Results

The results for a model run take the form of a print out of species concentrations at hourly intervals between 10 a.m. and 4 p.m. The full results are included as an Appendix to this report. In addition, the maximum ozone concentration, and the time at which it occurred are included in Table 2.

For many of the model runs the time of occurrence of the ozone maximum was 4 p.m., which indicates that the true maximum had not yet been achieved. However, it should be remembered that the model did not treat the process of pollutant emission or dry deposition. Such simplified models have been found to predict ozone concentrations whcih continue to increase into the late afternoon (Davis et al., 1983). If pollutant emission and dry deposition are included in the model the predicted ozone levels are generally found to peak earlier in the afternoon, and then to decrease under the combined effect of scavenging by vehicular emissions of NO and removal by dry deposition. The maximum ozone concentration seen during the model run has therefore been accepted as a reasonable representation of the peak ozone concentration for the day.

Also included in Table 2 are the total $NO_x$ and hydrocarbon concentrations, as well as their ratio, since these quantities have often been considered in analysing the production of atmospheric ozone.

Figure 3 is a plot of the peak ozone concentration against the hydrocarbon to $NO_x$ ratio for all model runs. There is clearly not a one to one correspondence between ozone concentration and the ratio, since a range of ozone concentrations is produced for different sets of initial conditions corresponding to the same value of $HC/NO_x$. However, it appears that the highest peak ozone concentrations are not observed for high or low values of $HC/NO_x$, i.e. for $HC/NO_x$ greater than about 20 or less than 5. The relationship between these quantities is explored further in the following sections.

### 4.1 Dependence of O3 on $HC/NO_x$

4.1.1 Clean Day and Variations. The plot of peak ozone concentration versus initial $HC/NO_x$ for the clean day, and perturbations of its initial conditions is shown in Figure 4. Note that when changes were made to $NO_x$ the ratio of NO to $NO_2$ was kept constant. As Figure 4 shows, if the hydrocarbon concentration is held constant, and the $NO_x$ concentration is changed, the

peak ozone concentration passes through a maximum, corresponding approximately to the base case (clean day) conditions. However, if the $NO_x$ is held constant, and the hydrocarbon concentration is increased by factors of 1.5 or 5 the peak ozone concentration is increased. The sensitivity of ozone production to changes in hydrocarbon concentrations appears to be lower than it is to $NO_x$, since for a 50% increase in both concentrations a decrease in peak ozone concentration is found. That is, the increase brought about by a 50% increase in hydrocarbons is not large enough to offset the decrease produced by the 50% increase in $NO_x$.

Although the effect of decreasing HC concentrations was not explicitly modelled, it has been shown by others (e.g. CARB, 1986; Chock et al., 1981) that such a decrease leads to lower ozone concentrations. Taking these conclusions together with the results of the present study, it appears that for the clean day conditions ozone could be controlled by controlling either (or both) of $NO_x$ or hydrocarbons, with $NO_x$ control possibly being more effective. The clean day base case appears to correspond to the $NO_x$ concentration which produces the highest peak ozone concentration.

4.1.2 Dirty Day and Variations. Figure 5 shows the plot of peak ozone concentration versus $HC/NO_x$ for the dirty day conditions. Although the predicted ozone concentrations are substantially higher than for the clean day, the dependence on initial conditions is very similar. That is, for both increase and decrease in initial $NO_x$ at constant initial hydrocarbon levels, the peak ozone concentration is predicted to decrease. This is similar to the clean day case, as is the observation of a substantial increase in peak ozone with increasing initial hydrocarbon concentration. What is different in this set of simulations is that if both hydrocarbons and $NO_x$ are increased the peak ozone concentration also increases. That is, for the dirty day the sensitivity of ozone production is higher to hydrocarbon concentration than it is to $NO_x$. It should be pointed out, however, that a 50% increase in hydrocarbons for the dirty day represents a substantially greater increase in absolute concentration than it does on the clean day, because of the much lower concentrations in the latter case.

This apparent difference in relative sensitivity to HC and $NO_x$ between the clean and dirty initial conditions demonstrates the inherent non-linearity of ozone production. Because of this it is important to note that the quantitative effect of controls will be dependent on the base case conditions to which the controls are applied.

4.1.3 Other Initial Conditions. Fourteen further sets of initial conditions were set for model runs, to allow a good range to be explored. Eight of these corresponded to "real" days during the Sarnia Oxidant Study (Figure 6), the remaining six were chosen to complete the range, and results for this group are shown in Figure 7. In both of these figures there is a suggestion that peak ozone concentration passes through a maximum with increasing $HC/NO_x$. The behaviour in these cases is different from that of the clean and dirty days because changes in $HC/NO_x$ are accompanied by changes in the hydrocarbon composition, and thus in the reactivity of the hydrocarbon mixture. This question is discussed further in Section 4.3.

## 4.2 Isopleth Plots

Early modelling of ozone production was based on EKMA (Empirical Kinetic Modelling Approach; e.g. Dodge, 1977), in which a simple chemical model was exercised to construct isopleths of peak ozone concentration as a function of initial $NO_x$ and hydrocarbon concentrations. It is now recognised that the simple model employed in the early work did not adequately reflect the reactivity of the ambient hydrocarbon mixtures encountered in urban areas. This problem is illustrated in Figure 8, which shows a plot of the initial conditions used in our model simulations, by both $NO_x$ and hydrocarbon. The individual points are labelled with the peak ozone concentration observed for that run. It is very clear that ozone isopleths could not easily be drawn through these points as is done in EKMA. The reason, as was mentioned previously, is that the reactivity of the hydrocarbon mixture can vary substantially for apparently similar hydrocarbon concentrations. However, it is generally true that lower ozone concentrations are associated with initial hydrocarbon concentrations of less than 100 ppb.

## 4.3 Hydrocarbon Reactivity

This modelling study was not specifically designed to assess the effects of hydrocarbon composition or reactivity on ozone production. However some insights may be gained by comparing those sets of conditions which have similar $NO_x$ and hydrocarbon concentrations, but which give rise to different ozone levels. Two groups will be considered, one set labelled A1, A2 and A3 corresponding to clean conditions (runs 3, 18, and 19), and one to generally dirty conditions (labelled B1, B2 and B3 corresponding to runs 2, 20, and 29). Table 3 contains the data for these runs, extracted from Table 2 and grouped to facilitate the comparison.

The only difference between runs A1 and A2 in the first group is in the split between NO and $NO_2$, being 10 and 3 ppb respectively for A1, and 7.5 and 4.5 for A2. It is clear that an atmosphere containing a greater proportion of $NO_2$ relative to NO is more reactive, leading to the production of 43.2 ppb of ozone as compared with 38.1 ppb. This appears to be a relatively small increase, but it should be remembered that this amount includes an initial ozone concentration of 30.3 ppb. That is, the higher $NO_2$ conditions actually give rise to approximately 50% higher ozone production (12.9 ppb compared with 7.8 ppb). The reason for the increased production is probably because $NO_2$ is fairly readily photolysed to produce an oxygen atom and then an ozone molecule, whereas NO must first be oxidised, generally consuming a molecule of ozone in the process.

If runs A2 and A3 are compared, the difference is seen to be an increase of 50% for A3 in the initial concentrations of alkanes, alkenes, aromatics and carbonyl compounds. This increase leads to a 75% increase in produced ozone (21.75 ppb compared with 12.9 ppb). This is consistent with the increased reactivity for A3 relative to A2, brought about by the increases in formaldehyde, aromatics and alkenes.

In the second group of runs, identical ozone peaks were produced in B1 and B2, in spite of a small increase in both NO and $NO_2$ in the latter case. Very much less ozone was produced in run B3, 47.2 ppb compared with 121.5 ppb, or in comparing the amount in excess of the initial concentration, 17.2 ppb compared with 41.6 ppb. The factor of 2.5 difference can be attributed to the decrease in initial hydrocarbon concentrations in B3 relative to B1 and B2. The decrease was about 25% overall, but more important was the factor of two or more decrease in formaldehyde, ketones and aromatics, which was sufficient to offset the effect of the increased alkene concentrations in B3.

### 4.4 Discussion

The main thrust of this modelling project was to determine whether control of $NO_x$ or hydrocarbons in the Sarnia area would lead to control of ozone production, and it is clear from the results obtained that controlling either, or both together would lead to reductions in the amount of ozone produced. It should be noted that the $HC/NO_x$ ratios for the clean and dirty days are 3.4 and 5.3 ppbC/ppb respectively. Previous studies (e.g. Chock et al., 1981; CARB, 1986) have indicated that at these low ratios hydrocarbon control is expected to be beneficial, but $NO_x$ control is expected to lead to higher levels of ozone. This apparent contradiction may be resolved when it is realised that the pollutant concentrations found in the Sarnia area, and treated in this study, are low when compared with those typically encountered in urban areas in the U.S. The difference that this makes is illustrated by the general EKMA isopleth diagram shown in Figure 9. The range of conditions covered by this study lies within the dotted area at the lower left of the figure. Within this region, even for low $HC/NO_x$, a reduction in $NO_x$ or in HC will lead to a reduction in peak ozone concentrations.

It is beyond the ability of the model used in this study to determine the emissions reduction required to achieve a given ozone concentration, since it treats only initial conditions, and does not explicitly include emissions. However some guidance may be derived from these results, as follows.

Consider Table 4, which contains results extracted from Table 2 for the clean and dirty days, and for these conditions perturbed separately by a 50% decrease in $NO_x$ and a 50% increase in hydrocarbons. Note that the hydrocarbon case is based on an increase, because decreased hydrocarbons were not modelled.

For both clean and dirty conditions 1.4 ppb less ozone is produced for every 1 ppb less $NO_x$ in the initial mixture. However, ozone production on the dirty day is less sensitive to changes in hydrocarbons than it is on the clean day (0.11 ppb/ppbC as opposed to 0.33 ppb/ppbC). The reason for this is that the initial hydrocarbon mixture on the dirty day contains relatively much more of the less reactive alkanes than it does on the clean day. As calculated here each molecule of alkane is assumed to contain 5

carbon atoms. The clean day mixture therefore contains 17 ppbC of alkanes, or 62% of the total, compared with 87 ppbC or 75% of the total on the dirty day.

It is therefore clear that when measured in terms of concentration, as described above, control of $NO_x$ is more effective than is control of hydrocarbons. However, this statement is oversimplified, since it does not take into consideration the importance of the actual initial conditions in determining the magnitude of the effect produced by changing hydrocarbon and/or $NO_x$ concentrations. It also ignores two very important issues, namely the relative costs of controlling hydrocarbons and $NO_x$, and the fact that control of selected hydrocarbons could be much more effective in controlling ozone than a blanket reduction.

The more likely case, though, is control expressed in percentage terms, e.g. 40% reduction in $NO_x$ or hydrocarbons. When expressed in these terms hydrocarbon control is probably still less effective, as is best seen from Figures 5 and 6, which contain points for 50% change in both species. Specifically, a 50% change in $NO_x$ for the clean day produces a 12% change in ozone concentration, compared with an 8% change if the hydrocarbon concentrations are changed by 50%. For the dirty day the figures are 12% and 6% for 50% change in $NO_x$ and hydrocarbon respectively.

A more fundamental question must also be addressed (although it is not within the terms of reference of this investigation, and will not be answered here). In the model simulations presented here the atmosphere in the Sarnia area has been shown to be capable of generating up to about 65 ppb of ozone. It is very important to remember, however, that this amount is superimposed on the initial concentration, which, at approximately 80 ppb for the dirty day, was already almost at the maximum acceptable level. It is well known that high initial concentrations can be imported into the area from south of the border (Yap et al., 1987; Davis et al., 1986), and that they can exceed the guideline ozone concentration. It therefore follows that total elimination of oxidant forming emissions in southern Ontario would still be ineffective in bringing the problem completely under control. The question to be answered then is whether it is really worth attempting to control these emissions at all, given that compliance with Canadian air quality guidelines may not be achievable under the present conditions.

## 5. Conclusions and Discussion

The conclusions from this modelling study are summarised below:

1. For two days during the Sarnia Oxidant Study having very different pollutant levels the initial $NO_x$ concentration in the Sarnia area appeared to be optimum for ozone production. That is, the predicted ozone concentration was reduced for an increase or a decrease in $NO_x$.

2. Conditions relating to several other days of the Sarnia Oxidant Study were also modelled. Generally good agreement was found between predicted and measured peak ozone levels, but the sensitivity of the

results to changes in initial conditions was not investigated.

3. Increasing the initial hydrocarbon concentration led to increased peak ozone concentrations.

4. Ozone concentrations can be reduced by controlling either $NO_x$ or hydrocarbons.

5. On the basis of both concentration change and percentage change control of $NO_x$ appears to be more effective than control of hydrocarbons in reducing ozone concentrations. This conclusion may be dependent on the actual initial conditions.

6. In light of the high concentrations of ozone transported into southern Ontario from the south, it is not clear that emission controls in the Sarnia region would be able to bring about sufficient improvement in ozone levels for guidelines to be met.

In assessing the conclusions of this study it is important to note again the relative simplicitly of certain components of the model. Because pollutant emission is not treated, the model can not be used to develop a detailed ozone control strategy for a given area. However, the chemistry module used in the model is detailed and well validated, so that the general conclusions regarding the dependence of ozone production on initial conditions drawn in this work are valid. These conclusions are applicable to other areas, besides Sarnia, having similar concentrations of hydrocarbons and $NO_x$ since there are no site specific features included in the model.

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Table 1. Test of Model Predictions

| Day | Observed | | Predicted | |
|---|---|---|---|---|
| | Ozone (ppb) | Time | Ozone (ppb) | Time |
| June 28 | 62 | 1400 | 56 | 1600 |
| July 3 | 108 | 1700 | 122 | 1600 |
| July 7 | 31 | 1400 | 45 | 1600 |
| July 8 | 68 | 1530 | 53 | 1300 |
| July 8* | 68 | 1530 | 83 | 1600 |
| July 14 | 120 | 1200 | 121 | 1600 |
| July 16 | 42 | 1200 | 39 | 1600 |
| July 18 | 40 | 1300 | 34 | 1200 |

* Second set of initial conditions - see Section 3.

Table 2. Summary of Initial Conditions and Predicted Ozone Maxima

| Species | Run<br>Units | 1<br>Clean day<br>(28 June) | 2<br>Dirty day<br>(3 July) | 3<br>Clean day<br>2*NO | 4<br>Clean day<br>f*HC | 5<br>Dirty day<br>2*NO | 6<br>Dirty day<br>f*HC |
|---|---|---|---|---|---|---|---|
| SO2 | ppb | 9.3 | 1.14 | 9.3 | 9.3 | 1.1 | 1.1 |
| SO4 | ug/m^3 | 12 | 64 | 12 | 12 | 64 | 64 |
| NO | ppb | 5.0 | 9.0 | 10.0 | 10.0 | 18.1 | 18.1 |
| NO2 | ppb | 3 | 13 | 3 | 3 | 13 | 13 |
| O2 | ppb | 30.3 | 79.9 | 30.3 | 30.3 | 79.9 | 79.9 |
| H2O2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| HNO3 | ppb | 0.612 | 4.03 | 0.612 | 0.612 | 4.03 | 4.03 |
| PAN1 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| PAN2 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| C3H8 | ppb | 2.46 | 5.05 | 2.46 | 12.30 | 5.05 | 25.30 |
| ALKA | ppb | 3.4 | 17.4 | 3.4 | 17.0 | 17.4 | 86.8 |
| ETHE | ppb | 0.009 | 0.009 | 0.009 | 0.043 | 0.009 | 0.044 |
| ALKE | ppb | 0.006 | 0.006 | 0.006 | 0.103 | 0.006 | 0.105 |
| AROM | ppb | 0.42 | 2.04 | 0.42 | 0.84 | 2.04 | 4.09 |
| HCHO | ppb | 2.0 | 3.4 | 2.0 | 10.0 | 3.4 | 17.0 |
| ALD2 | ppb | 0.4 | 4.9 | 0.4 | 2.0 | 4.9 | 24.5 |
| KET | ppb | 1.3 | 2.0 | 1.3 | 6.5 | 2.0 | 10.0 |
| HONO | ppb | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| RNO3 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| ROOH | ppb | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| CRES | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| DIAL | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| MGLY | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| HO2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| RO2S | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RO2L | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RAO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| KO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RCO3 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| NH3 | ppb | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 |
| NOx | ppb | 8.0 | 22.0 | 13.0 | 13.0 | 31.1 | 31.1 |
| HC | ppbC | 27.33 | 116.48 | 27.33 | 128.35 | 116.48 | 539.09 |
| HC/NOx | | 3.41 | 5.28 | 2.10 | 9.87 | 3.75 | 17.33 |
| Max O3 | (ppb) | 55.65 | 121.5 | 38.1 | 67.7 | 98.1 | 145.5 |
| at time: | | 1600 | 1600 | 1600 | 1400 | 1600 | 1300 |

Table 2 continued

| Species | Run / Units | 7 Clean day 1.5*HC | 8 Dirty day 1.5*HC | 9 Clean NOx pert. | 10 Clean NOx pert. | 11 Clean NOx pert. | 12 Clean NOx pert. |
|---|---|---|---|---|---|---|---|
| SO2 | ppb | 9.3 | 1.14 | 9.3 | 9.3 | 9.3 | 9.3 |
| SO4 | ug/m^3 | 12 | 64 | 12 | 12 | 12 | 12 |
| NO | ppb | 5.0 | 9.0 | 2.5 | 1.4 | 1.0 | 0.7 |
| NO2 | ppb | 3.0 | 13.0 | 1.5 | 0.8 | 0.5 | 0.4 |
| O3 | ppb | 30.3 | 79.9 | 30.3 | 30.3 | 30.3 | 30.3 |
| H2O2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| HNO3 | ppb | 0.612 | 4.03 | 0.612 | 0.612 | 0.612 | 0.612 |
| PAN1 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| PAN2 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| C3H8 | ppb | 3.70 | 7.61 | 2.46 | 2.46 | 2.46 | 2.46 |
| ALKA | ppb | 5.11 | 26.00 | 3.39 | 3.39 | 3.39 | 3.39 |
| ETHE | ppb | 0.013 | 0.013 | 0.009 | 0.009 | 0.009 | 0.009 |
| ALKE | ppb | 0.009 | 0.009 | 0.006 | 0.006 | 0.006 | 0.006 |
| AROM | ppb | 0.634 | 3.08 | 0.422 | 0.422 | 0.422 | 0.422 |
| HCHO | ppb | 3.00 | 5.11 | 2.00 | 2.00 | 2.00 | 2.00 |
| ALD2 | ppb | 0.60 | 7.33 | 0.40 | 0.40 | 0.40 | 0.40 |
| KET | ppb | 1.95 | 3.00 | 1.30 | 1.30 | 1.30 | 1.30 |
| HONO | ppb | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| RNO3 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| ROOH | ppb | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| CRES | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| DIAL | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| MGLY | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| HO2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| RO2S | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RO2L | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RAO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| KO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RCO3 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| NH3 | ppb | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 |
| NOx | ppb | 8.0 | 22.0 | 4.0 | 2.2 | 1.5 | 1.1 |
| HC | ppbC | 41.16 | 174.46 | 27.33 | 27.33 | 27.33 | 27.33 |
| HC/NOx | | 5.13 | 7.92 | 6.83 | 12.42 | 18.22 | 24.84 |
| Max O3 (ppb) | | 60.0 | 128.0 | 50.2 | 43.3 | 39.8 | 37.5 |
| at time: | | 1600 | 1500 | 1600 | 1300 | 1300 | 1200 |

Table 2 continued

| Species | Run / Units | 13 Dirty NOx pert. | 14 Dirty NOx pert. | 15 Dirty NOx pert. | 16 Dirty NOx pert. | 17 Clean NOx pert. | 18 Clean NOx pert. |
|---|---|---|---|---|---|---|---|
| SO2 | ppb | 1.1 | 1.1 | 1.1 | 1.1 | 9.3 | 9.3 |
| SO4 | ug/m^3 | 64 | 64 | 64 | 64 | 12 | 12 |
| NO | ppb | 4.5 | 2.7 | 2.0 | 1.6 | 6.7 | 7.5 |
| NO2 | ppb | 6.5 | 3.9 | 3.0 | 2.4 | 3.5 | 4.5 |
| O3 | ppb | 79.9 | 79.9 | 79.9 | 79.9 | 30.3 | 30.3 |
| H2O2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| HNO3 | ppb | 4.03 | 4.03 | 4.03 | 4.03 | 0.612 | 0.612 |
| PAN1 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| PAN2 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| C3H8 | ppb | 5.05 | 5.05 | 5.05 | 5.05 | 2.46 | 2.46 |
| ALKA | ppb | 17.4 | 17.4 | 17.4 | 17.4 | 3.39 | 3.39 |
| ETHE | ppb | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 |
| ALKE | ppb | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 |
| AROM | ppb | 2.04 | 2.04 | 2.04 | 2.04 | 0.42 | 0.42 |
| HCHO | ppb | 3.4 | 3.4 | 3.4 | 3.4 | 2.0 | 2.0 |
| ALD2 | ppb | 4.9 | 4.9 | 4.9 | 4.9 | 0.4 | 0.4 |
| KET | ppb | 2.0 | 2.0 | 2.0 | 2.0 | 1.3 | 1.3 |
| HONO | ppb | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| RNO3 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| ROOH | ppb | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| CRES | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| DIAL | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| MGLY | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| HO2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| RO2S | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RO2L | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RAO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| KO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RCO3 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| NH3 | ppb | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 |
| NOx | ppb | 11.0 | 6.6 | 5.0 | 4.0 | 10.2 | 12.0 |
| HC | ppbC | 116.48 | 116.48 | 116.48 | 116.48 | 27.33 | 27.33 |
| HC/NOx | | 10.59 | 17.65 | 23.20 | 29.12 | 2.68 | 2.28 |
| Max O3 | (ppb) | 106.5 | 97.9 | 93.4 | 90.3 | 49.0 | 43.2 |
| | time: | 1300 | 1200 | 1200 | 1200 | 1600 | 1600 |

Table 2 continued

| Species | Run / Units | 19 Clean NOx pert. | 20 Dirty NOx pert. | 21 Dirty NOx pert. | 22 Dirty NOx pert. | 23 28 June | 24 7July |
|---|---|---|---|---|---|---|---|
| SO2 | ppb | 9.3 | 1.1 | 1.1 | 1.1 | 9.6 | 2.5 |
| SO4 | ug/m^3 | 12 | 64 | 64 | 64 | 25 | 6 |
| NO | ppb | 7.5 | 9.8 | 11.0 | 13.5 | 0.2 | 0.6 |
| NO2 | ppb | 4.5 | 14.7 | 16.5 | 19.5 | 0.6 | 1.3 |
| O3 | ppb | 30.3 | 79.9 | 79.9 | 79.9 | 45.0 | 30.0 |
| H2O2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 1.4 | 0.9 |
| HNO3 | ppb | 0.61 | 4.03 | 4.03 | 4.03 | 0.60 | 0.60 |
| PAN1 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| PAN2 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| C3H8 | ppb | 3.70 | 5.05 | 5.05 | 7.50 | 0.98 | 1.72 |
| ALKA | ppb | 5.1 | 17.4 | 17.4 | 26.0 | 2.6 | 2.4 |
| ETHE | ppb | 0.014 | 0.009 | 0.009 | 0.014 | 0 | 0 |
| ALKE | ppb | 0.009 | 0.006 | 0.006 | 0.009 | 0 | 0 |
| AROM | ppb | 0.63 | 2.04 | 2.04 | 3.00 | 0.10 | 0 |
| HCHO | ppb | 3.0 | 3.4 | 3.4 | 5.1 | 2.0 | 1.5 |
| ALD2 | ppb | 0.6 | 4.9 | 4.9 | 7.3 | 0.4 | 1.3 |
| KET | ppb | 2.0 | 2.0 | 2.0 | 3.0 | 1.3 | 0.5 |
| HONO | ppb | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| RNO3 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| ROOH | ppb | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| CRES | ppb | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 |
| DIAL | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| MGLY | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| HO2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| RO2S | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RO2L | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RAO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| KO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RCO3 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| NH3 | ppb | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 |
| NOx | ppb | 12.0 | 24.5 | 27.5 | 33.0 | 0.8 | 1.9 |
| HC | ppbC | 41.16 | 116.48 | 116.48 | 173.57 | 16.64 | 17.16 |
| HC/NOx | | 3.43 | 4.75 | 4.24 | 5.26 | 20.80 | 9.03 |
| Max O3 (ppb) | | 52.1 | 121.5 | 116.0 | 126.5 | 46.0 | 44.8 |
| at time: | | 1600 | 1600 | 1600 | 1600 | 1200 | 1600 |

Table 2 continued

| | Run | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|
| Species | Units | 8 July | 8 July/2 | 14 July | 16 July | 17 July | 18Jul |
| SO2 | ppb | 11.3 | 11.3 | 27.8 | 0.0 | 5.0 | 2.4 |
| SO4 | ug/m^3 | 6 | 6 | 54 | 4 | 5 | 17 |
| NO | ppb | 2.3 | 8.0 | 1.0 | 1.1 | 5.0 | 1.0 |
| NO2 | ppb | 2.2 | 8.0 | 10.0 | 0.3 | 20.0 | 0.1 |
| O3 | ppb | 30 | 40 | 80 | 30 | 30 | 30 |
| H2O2 | ppb | 1.0 | 1.0 | 2.0 | 0.9 | 1.0 | 1.0 |
| HNO3 | ppb | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| PAN1 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| PAN2 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| C3H8 | ppb | 20.3 | 3.4 | 1.5 | 0.2 | 4.1 | 5.0 |
| ALKA | ppb | 38.4 | 14.0 | 36.9 | 13.4 | 13.4 | 12.9 |
| ETHE | ppb | 0 | 0 | 1.00 | 0 | 0.02 | 0 |
| ALKE | ppb | 0.6 | 0.2 | 2.3 | 0 | 0.2 | 0.1 |
| AROM | ppb | 2.4 | 7.8 | 5.2 | 0.2 | 0.8 | 0.6 |
| HCHO | ppb | 3.5 | 3.5 | 3.5 | 0.7 | 1.6 | 1.0 |
| ALD2 | ppb | 0.6 | 0.6 | 4.1 | 0 | 1.6 | 0 |
| KET | ppb | 0.5 | 0.5 | 9.4 | 0 | 3.5 | 0 |
| HONO | ppb | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| RNO3 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| ROOH | ppb | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| CRES | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| DIAL | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| MGLY | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| HO2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| RO2S | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RO2L | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RAO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| KO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RCO3 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| NH3 | ppb | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 |
| NOx | ppb | 4.5 | 16.0 | 11.0 | 1.4 | 25.0 | 1.1 |
| HC | ppbC | 272.40 | 135.88 | 237.75 | 69.20 | 85.56 | 84.15 |
| HC/NOx | | 60.53 | 8.49 | 21.61 | 49.43 | 3.42 | 76.50 |
| Max O3 (ppb) | | 52.8 | 83.0 | 121.4 | 38.6 | 47.2 | 34.5 |
| at time: | | 1300 | 1600 | 1600 | 1600 | 1600 | 1200 |

Table 2 continued

| | Run | 31 | 32 | 33 | 34 | 35 | 36 |
|---|---|---|---|---|---|---|---|
| Species | Units | A | B | C | D | E | F |
| SO2 | ppb | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 |
| SO4 | ug/m^3 | 17 | 17 | 17 | 17 | 17 | 17 |
| NO | ppb | 6 | 9 | 12 | 12 | 7 | 12 |
| NO2 | ppb | 8 | 12 | 18 | 16 | 10 | 20 |
| O3 | ppb | 40 | 40 | 40 | 40 | 30 | 30 |
| H2O2 | ppb | 1 | 1 | 1 | 2 | 1 | 1 |
| HNO3 | ppb | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| PAN1 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| PAN2 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| C3H8 | ppb | 3.0 | 2.2 | 3.0 | 1.5 | 5.0 | 2.5 |
| ALKA | ppb | 73.8 | 55.4 | 73.8 | 36.9 | 12.9 | 6.5 |
| ETHE | ppb | 2.0 | 1.5 | 2.0 | 1.0 | 0 | 0 |
| ALKE | ppb | 4.6 | 3.4 | 4.6 | 2.3 | 0.1 | 0.05 |
| AROM | ppb | 10.4 | 7.8 | 10.4 | 5.2 | 0.6 | 0.3 |
| HCHO | ppb | 7.0 | 5.2 | 7.0 | 3.5 | 1.0 | 0.5 |
| ALD2 | ppb | 8.2 | 6.1 | 8.2 | 4.1 | 0 | 0 |
| KET | ppb | 18.8 | 14.1 | 18.8 | 9.4 | 0 | 0 |
| HONO | ppb | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| RNO3 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| ROOH | ppb | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| CRES | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| DIAL | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| MGLY | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| HO2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| RO2S | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RO2L | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RAO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| KO2 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| RCO3 | ug/m^3 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| NH3 | ppb | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 |
| NOx | ppb | 14 | 21 | 30 | 28 | 17 | 32 |
| HC | ppbC | 475.5 | 356.5 | 475.5 | 237.8 | 84.2 | 42.3 |
| HC/NOx | | 33.96 | 16.98 | 15.85 | 8.49 | 4.95 | 1.32 |
| Max O3 (ppb) | | 91.2 | 104.3 | 125.7 | 103.4 | 41.3 | 29.8 |
| at time: | | 1300 | 1400 | 1500 | 1600 | 1600 | 1100 |

Table 3. Data to Illustrate Effect of Hydrocarbon Reactivity

| | Run | A1<br>3 | A2<br>18 | A3<br>19 | B1<br>2 | B2<br>20 | B3<br>29 |
|---|---|---|---|---|---|---|---|
| Species | Units | Clean Day 2*NO | Clean NOx pert. | Clean NOx pert. | Dirty day (3 July) | Dirty NOx pert. | 17Jul |
| SO2 | ppb | 9.300 | 9.300 | 9.300 | 1.140 | 1.140 | 5.000 |
| SO4 | ug/m^3 | 12.000 | 12.000 | 12.000 | 64.000 | 64.000 | 5.000 |
| NO | ppb | 10.000 | 7.500 | 7.500 | 9.040 | 9.800 | 5.000 |
| NO2 | ppb | 3.000 | 4.500 | 4.500 | 13.000 | 14.700 | 20.000 |
| O3 | ppb | 30.300 | 30.300 | 30.300 | 79.900 | 79.900 | 30.000 |
| H2O2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 1.000 |
| HNO3 | ppb | 0.612 | 0.612 | 0.612 | 4.030 | 4.030 | 0.600 |
| PAN1 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| PAN2 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| C3H8 | ppb | 2.460 | 2.460 | 3.700 | 5.050 | 5.050 | 4.100 |
| ALKA | ppb | 3.390 | 3.390 | 5.110 | 17.400 | 17.400 | 13.400 |
| ETHE | ppb | 0.009 | 0.009 | 0.014 | 0.009 | 0.009 | 0.020 |
| ALKE | ppb | 0.006 | 0.006 | 0.009 | 0.006 | 0.006 | 0.200 |
| AROM | ppb | 0.422 | 0.422 | 0.634 | 2.040 | 2.040 | 0.760 |
| HCHO | ppb | 2.000 | 2.000 | 3.000 | 3.400 | 3.400 | 1.600 |
| ALD2 | ppb | 0.400 | 0.400 | 0.600 | 4.900 | 4.900 | 1.600 |
| KET | ppb | 1.300 | 1.300 | 1.950 | 2.000 | 2.000 | 3.500 |
| HONO | ppb | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| RNO3 | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| ROOH | ppb | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| CRES | ppb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| DIAL | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| MGLY | ppb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| HO2 | ppb | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| RO2S | ug/m^3 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| RO2L | ug/m^3 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| RAO2 | ug/m^3 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| KO2 | ug/m^3 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| RCO3 | ug/m^3 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |
| NH3 | ppb | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 | 0.014 |
| NOx | ppb | 13.000 | 12.000 | 12.000 | 22.040 | 24.500 | 25.000 |
| HC | ppbC | 27.329 | 27.329 | 41.15 | 116.47 | 116.475 | 85.560 |
| HC/NOx | | 2.102 | 2.277 | 3.430 | 5.285 | 4.754 | 3.422 |
| Max O3 (ppb) | | 38.10 | 43.20 | 52.05 | 121.50 | 121.50 | 47.20 |
| at time: | | 1600 | 1600 | 1600 | 1600 | 1600 | 1600 |

Table 4. Estimate of the effect of controlling $NO_x$ and hydrocarbons

| Conditions | $O_3$ (ppb) | $NO_x$ (ppb) | HC (ppb) | $\delta O_3/\delta X$ |
|---|---|---|---|---|
| Clean | 55.56 | 8.02 | 27.33 | |
| - 50% $NO_x$ | 50.15 | 4.0 | | 1.4 |
| + 50% HC | 60.00 | | 41.16 | 0.33 |
| Initial | 30.3 | | | |
| Dirty | 121.5 | 22.04 | 116.48 | |
| - 50% $NO_x$ | 106.5 | 11.00 | | 1.4 |
| + 50% HC | 128.0 | | 174.46 | 0.11 |
| Initial | 79.9 | | | |

Note: X represents $NO_x$ or HC.

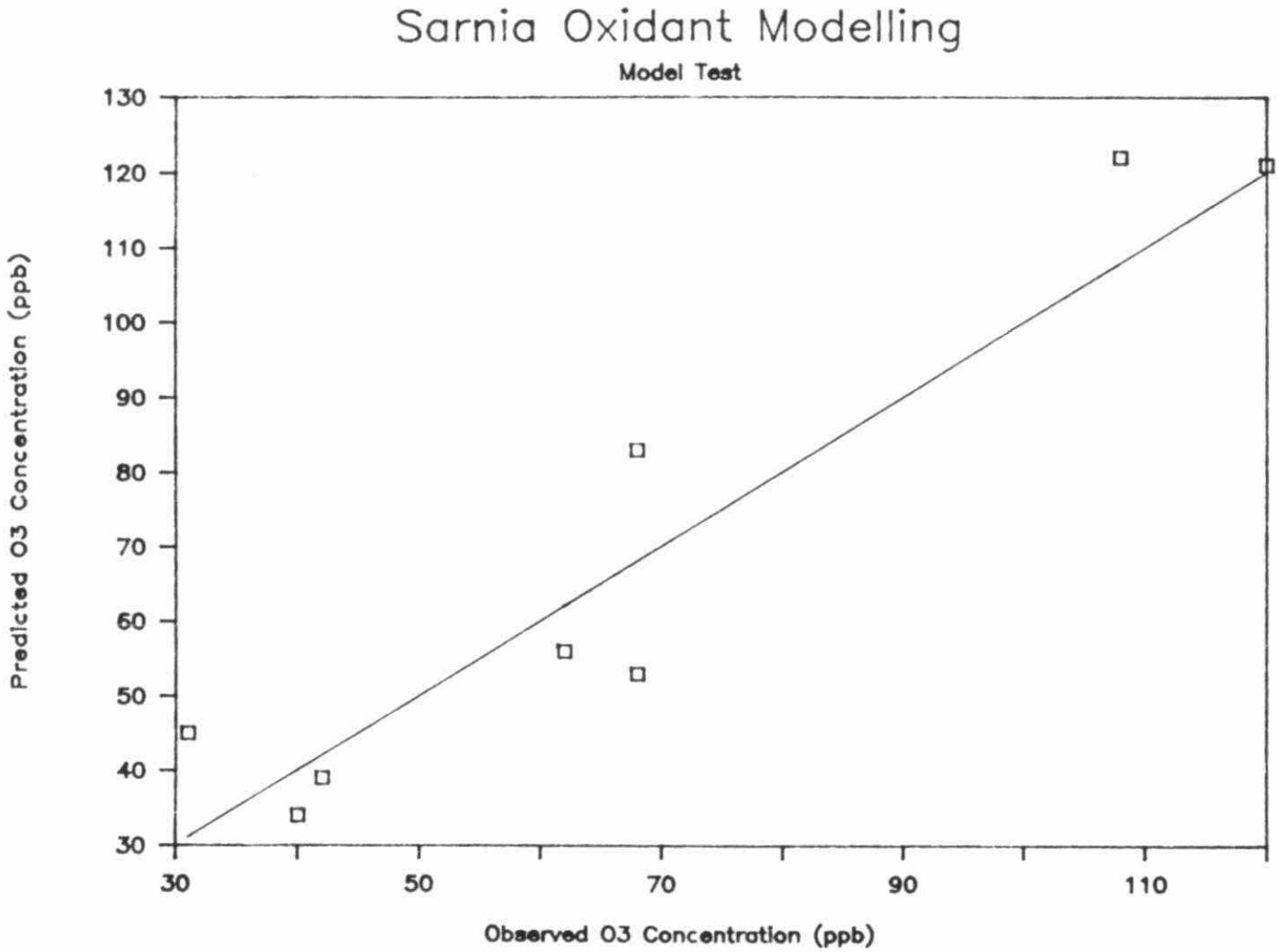



Figure 1. Plot of predicted vs. observed maximum ozone concentration on selected days

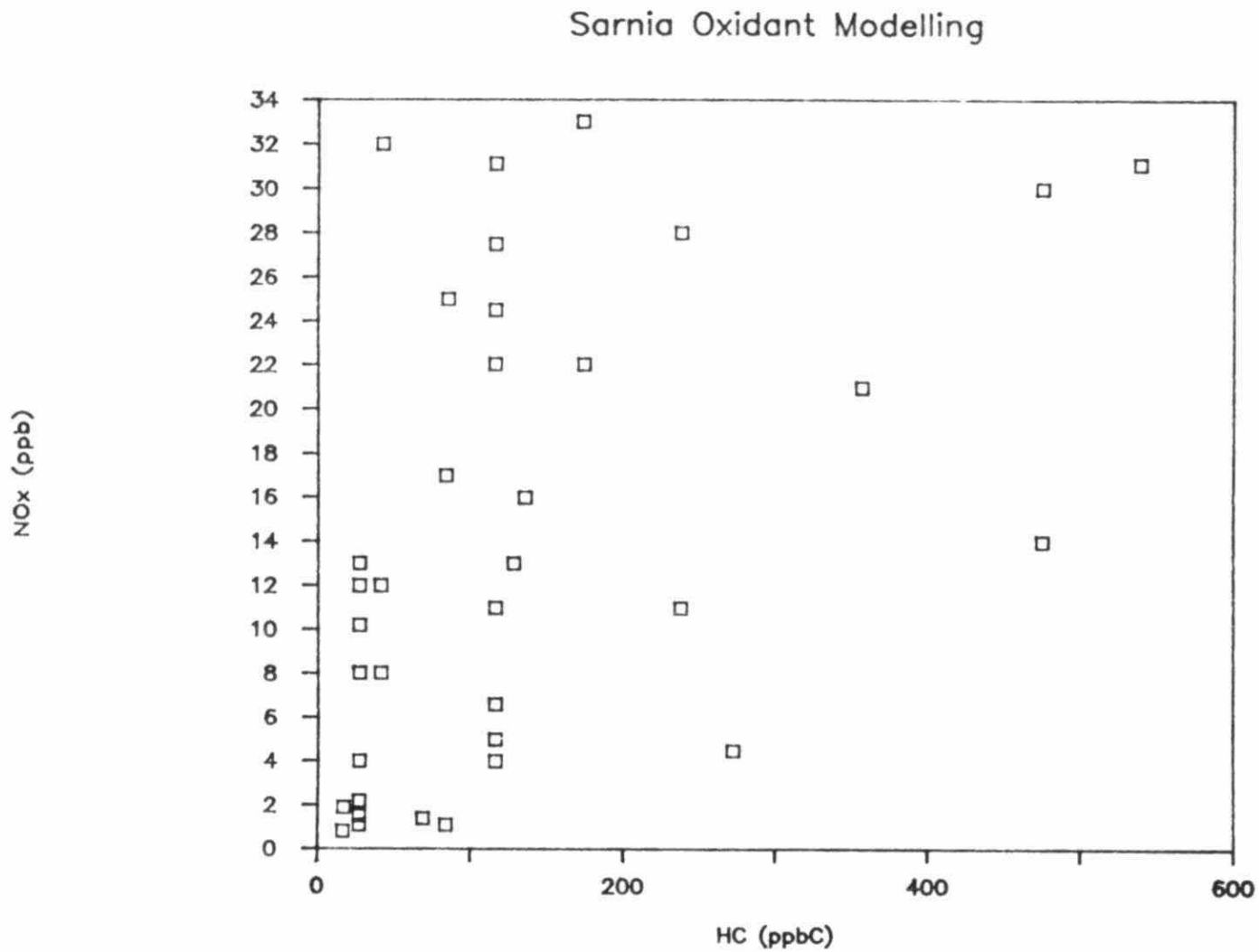



Figure 2. Initial conditions

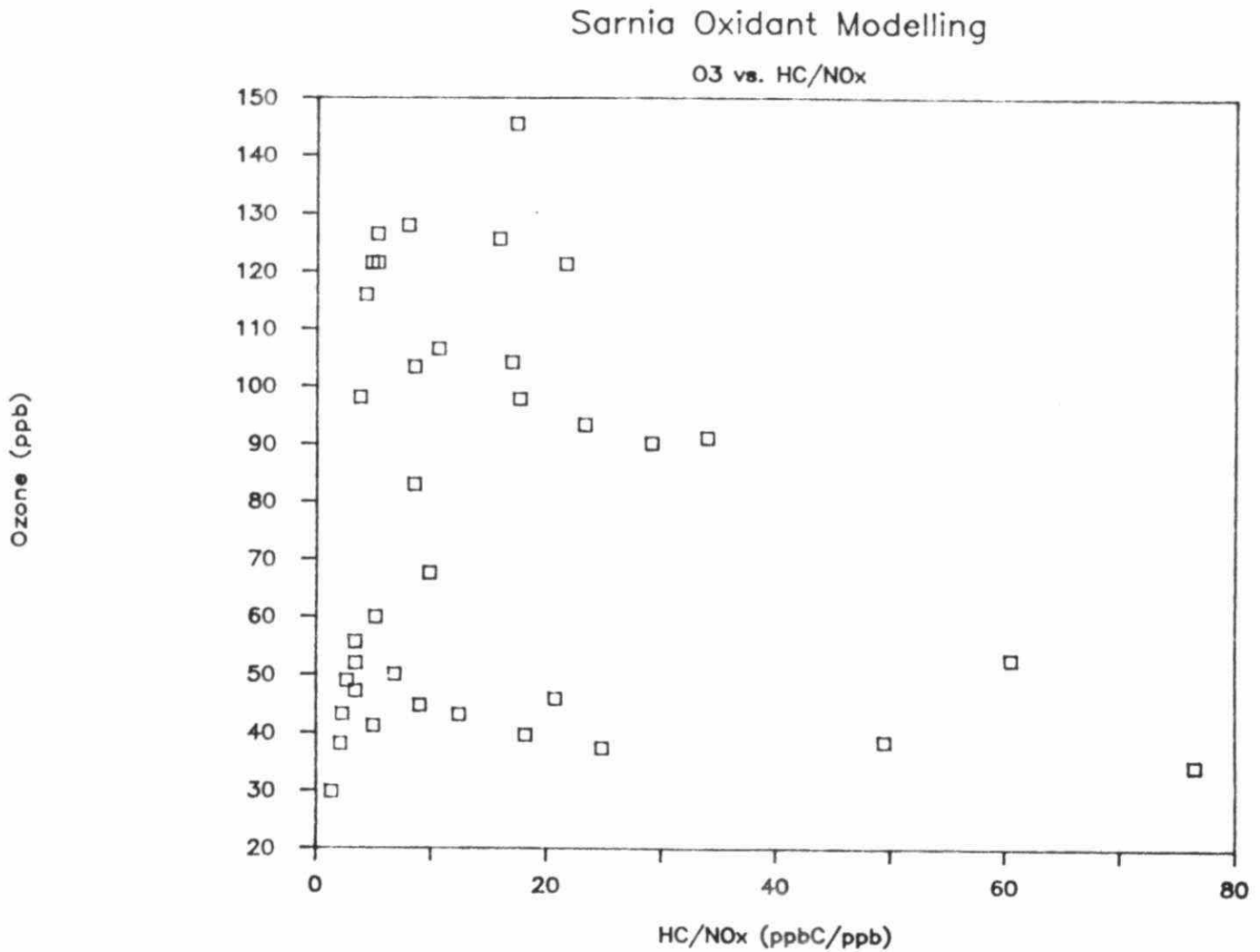



Figure 3. Plot of maximum predicted ozone concentration as a function of hydrocarbon to $NO_x$ ratio (all days)

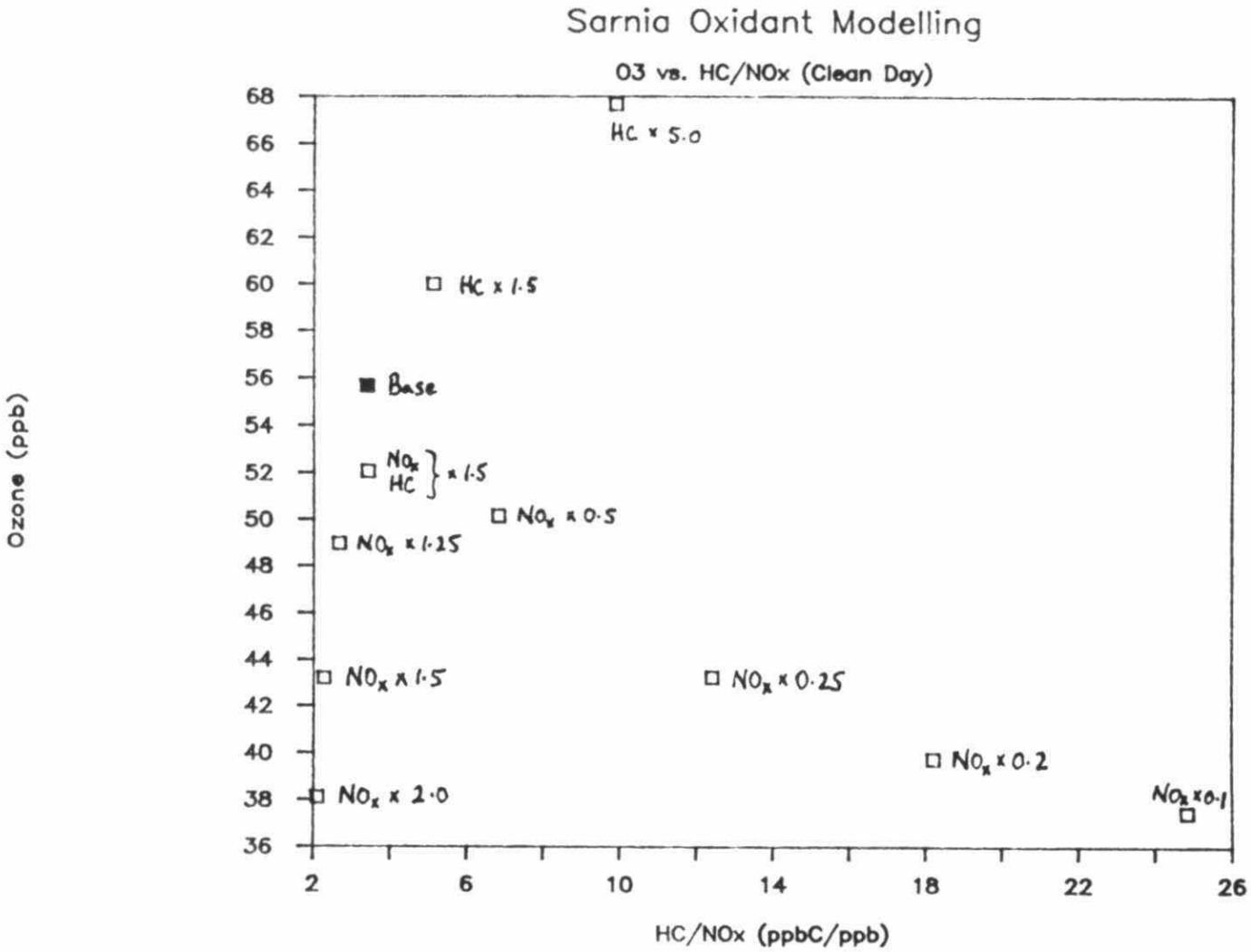



Figure 4. Plot of maximum predicted ozone concentration as a function of hydrocarbon to $NO_x$ ratio (clean day and perturbations)

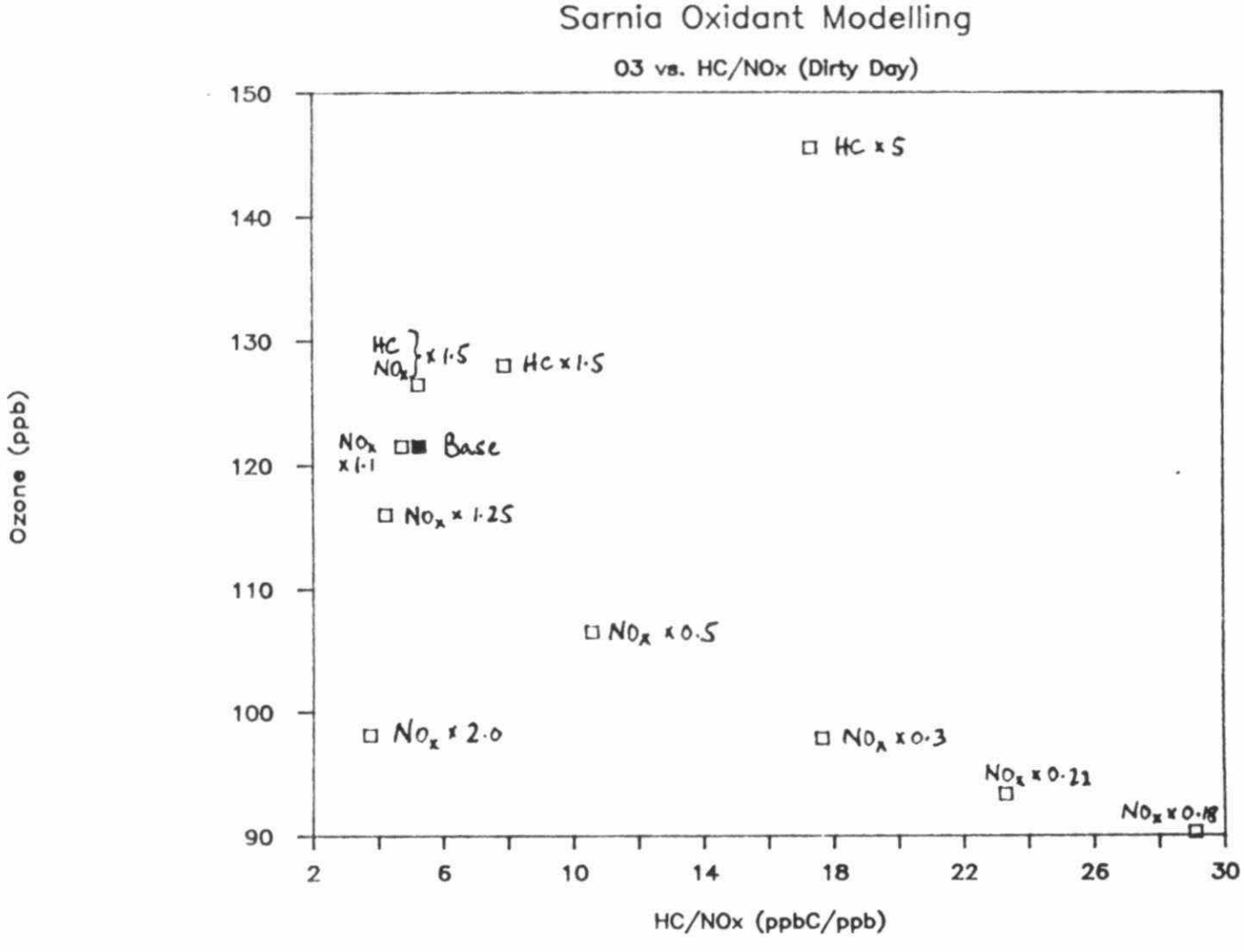



Figure 5. Plot of maximum predicted ozone concentration as a function of hydrocarbon to $NO_x$ ratio (dirty day and perturbations)

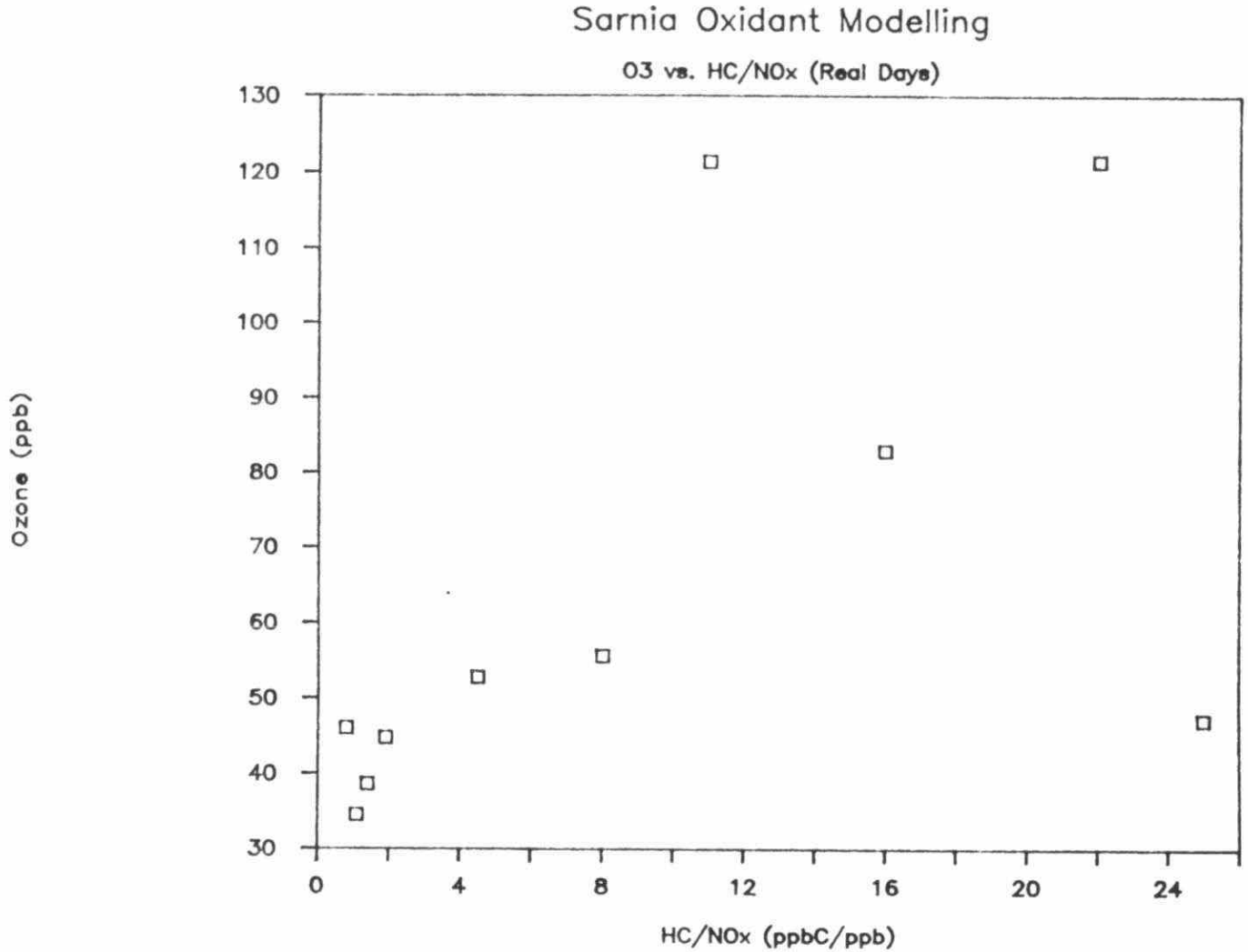



Figure 6. Plot of maximum predicted ozone concentration as a function of hydrocarbon to $NO_x$ ratio (real days)

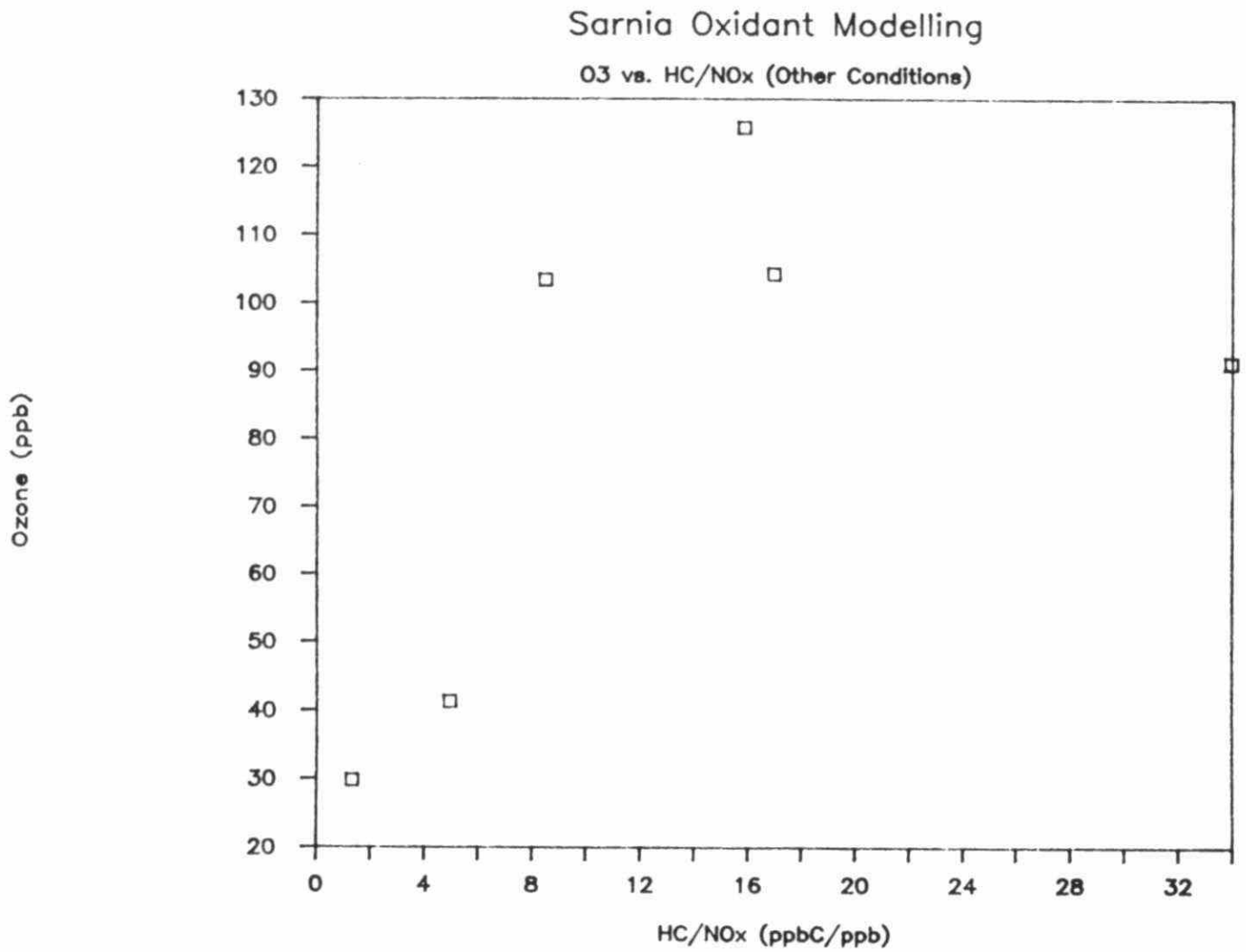



Figure 7. Plot of maximum predicted ozone concentration as a function of hydrocarbon to $NO_x$ ratio (other conditions)

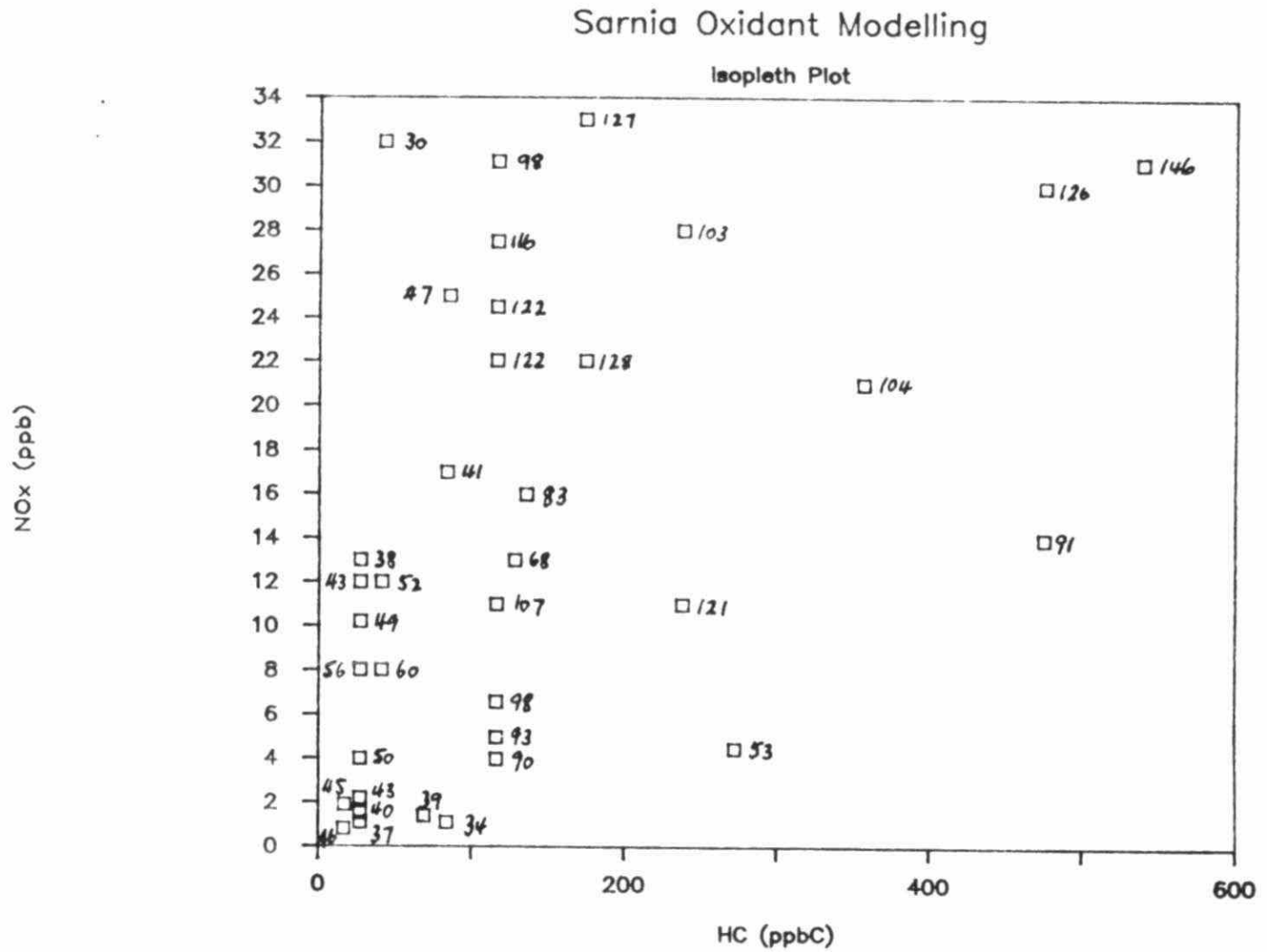
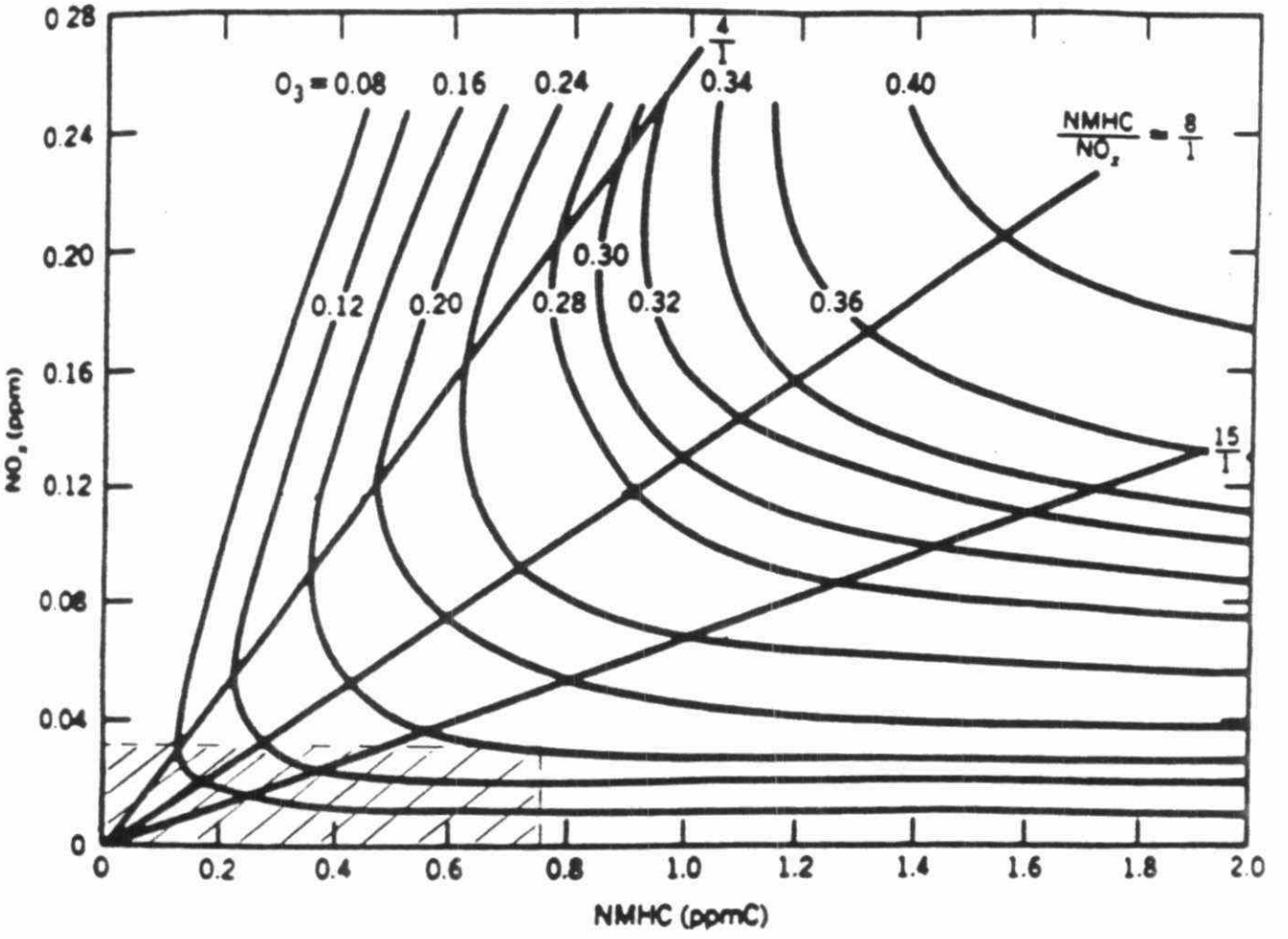



Figure 8. Points for isopleth plot. Indicated values are peak predicted ozone concentrations (ppb).




Ozone isopleths used in EKMA approach (from Dodge, 1977a).

Figure 9. General EKMA diagram. The shaded region contains the conditions modelled in this work.

. BASE LINE RUN (CLEAN DAY, JUNE 28)

Run 1

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 9.300 | 9.115 | 8.865 | 8.540 | 8.120 | 7.675 | 7.355 |
| SO4 | (ug/m^3) | 12.000 | 12.750 | 13.750 | 15.050 | 16.650 | 18.450 | 19.750 |
| NO | (PPB) | 5.020 | 2.995 | 2.190 | 1.380 | .678 | .259 | .112 |
| NO2 | (PPB) | 3.000 | 3.685 | 2.955 | 2.140 | 1.315 | .659 | .349 |
| O3 | (PPB) | 30.300 | 31.850 | 35.550 | 40.200 | 46.100 | 52.000 | 55.650 |
| H2O2 | (PPB) | .007 | .007 | .008 | .012 | .040 | .190 | .464 |
| HNO3 | (PPB) | .612 | 1.720 | 2.990 | 4.295 | 5.460 | 6.170 | 6.430 |
| PAN1 | (PPB) | .002 | .097 | .252 | .469 | .768 | 1.100 | 1.300 |
| PAN2 | (PPB) | .002 | .022 | .064 | .104 | .131 | .139 | .134 |
| C3H8 | (PPB) | 2.460 | 2.400 | 2.320 | 2.210 | 2.075 | 1.925 | 1.825 |
| ALKA | (PPB) | 3.390 | 3.130 | 2.795 | 2.400 | 1.960 | 1.560 | 1.310 |
| ETHE | (PPB) | .009 | .007 | .005 | .004 | .002 | .001 | .001 |
| ALKE | (PPB) | .006 | .003 | .001 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | .422 | .295 | .181 | .094 | .039 | .015 | .007 |
| HCHO | (PPB) | 2.000 | 1.445 | 1.160 | 1.055 | 1.043 | 1.002 | .917 |
| ALD2 | (PPB) | .400 | .522 | .604 | .635 | .613 | .556 | .503 |
| KET | (PPB) | 1.300 | 1.415 | 1.545 | 1.705 | 1.875 | 2.010 | 2.080 |
| HONO | (PPB) | .005 | .076 | .075 | .066 | .046 | .020 | .006 |
| RNO3 | (PPB) | .002 | .056 | .119 | .188 | .253 | .299 | .318 |
| ROOH | (PPB) | .004 | .004 | .005 | .006 | .014 | .059 | .153 |
| CRES | (PPB) | .002 | .013 | .012 | .008 | .003 | .001 | .001 |
| DIAL | (PPB) | .003 | .067 | .071 | .049 | .024 | .010 | .004 |
| MGLY | (PPB) | .003 | .050 | .056 | .043 | .025 | .012 | .008 |
| HO2 | (PPB) | .007 | .001 | .002 | .004 | .012 | .023 | .028 |
| RO2S | (ug/m^3) | .010 | .001 | .002 | .005 | .013 | .029 | .041 |
| RO2L | (ug/m^3) | .010 | .000 | .001 | .001 | .001 | .002 | .003 |
| RAO2 | (ug/m^3) | .010 | .001 | .001 | .002 | .004 | .009 | .010 |
| KO2 | (ug/m^3) | .010 | .000 | .000 | .000 | .001 | .002 | .002 |
| RCO3 | (ug/m^3) | .010 | .000 | .001 | .002 | .005 | .010 | .015 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

. BASE LINE RUN (DIRTY DAY, JULY 3 )

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 1.140 | 1.130 | 1.110 | 1.085 | 1.050 | 1.008 | .979 |
| SO4 | (ug/m^3) | 64.000 | 64.100 | 64.100 | 64.250 | 64.400 | 64.550 | 64.650 |
| NO | (PPB) | 9.040 | 4.390 | 3.210 | 1.945 | .834 | .200 | .040 |
| NO2 | (PPB) | 13.000 | 14.050 | 10.800 | 7.235 | 3.720 | 1.155 | .301 |
| O3 | (PPB) | 79.900 | 80.550 | 87.100 | 96.050 | 107.500 | 118.000 | 121.500 |
| H2O2 | (PPB) | .007 | .007 | .008 | .013 | .049 | .330 | .805 |
| HNO3 | (PPB) | 4.030 | 6.600 | 9.610 | 12.650 | 15.200 | 16.400 | 16.600 |
| PAN1 | (PPB) | .002 | .745 | 1.735 | 2.985 | 4.555 | 6.165 | 6.885 |
| PAN2 | (PPB) | .002 | .075 | .265 | .518 | .765 | .915 | .933 |
| C3H8 | (PPB) | 5.050 | 4.975 | 4.860 | 4.700 | 4.485 | 4.250 | 4.100 |
| ALKA | (PPB) | 17.400 | 16.500 | 15.350 | 13.850 | 11.950 | 10.060 | 8.985 |
| ETHE | (PPB) | .009 | .008 | .006 | .005 | .003 | .002 | .002 |
| ALKE | (PPB) | .006 | .003 | .001 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | 2.040 | 1.650 | 1.205 | .774 | .418 | .203 | .123 |
| HCHO | (PPB) | 3.400 | 2.775 | 2.500 | 2.460 | 2.485 | 2.340 | 2.010 |
| ALD2 | (PPB) | 4.900 | 4.575 | 4.200 | 3.790 | 3.370 | 2.925 | 2.545 |
| KET | (PPB) | 2.000 | 2.350 | 2.820 | 3.435 | 4.170 | 4.845 | 5.135 |
| HONO | (PPB) | .005 | .071 | .074 | .065 | .042 | .013 | .002 |
| RNO3 | (PPB) | .002 | .167 | .392 | .667 | .967 | 1.215 | 1.310 |
| ROOH | (PPB) | .004 | .004 | .005 | .008 | .030 | .225 | .845 |
| CRES | (PPB) | .002 | .043 | .055 | .045 | .028 | .015 | .009 |
| DIAL | (PPB) | .003 | .234 | .328 | .304 | .211 | .116 | .066 |
| MGLY | (PPB) | .003 | .160 | .228 | .226 | .175 | .110 | .070 |
| HO2 | (PPB) | .007 | .001 | .002 | .005 | .014 | .034 | .034 |
| RO2S | (ug/m^3) | .010 | .002 | .003 | .008 | .023 | .079 | .159 |
| RO2L | (ug/m^3) | .010 | .001 | .001 | .003 | .006 | .016 | .036 |
| RAO2 | (ug/m^3) | .010 | .001 | .002 | .006 | .017 | .055 | .104 |
| KO2 | (ug/m^3) | .010 | .000 | .000 | .000 | .001 | .004 | .009 |
| RCO3 | (ug/m^3) | .010 | .001 | .002 | .004 | .011 | .042 | .120 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 2

Run 3

. PERTURBED NO EQUALS TO TWO TIMES BASE LINE CONC (CLEAN DAY, JUNE 28

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | PPB) | 9.300 | 9.185 | 9.040 | 8.875 | 8.695 | 8.515 | 8.350 |
| SO4 | ug/m^3) | 12.000 | 12.450 | 13.050 | 13.700 | 14.400 | 15.150 | 15.750 |
| NO | PPB) | 10.000 | 5.675 | 4.925 | 4.105 | 3.310 | 2.605 | 2.050 |
| NO2 | PPB) | 3.000 | 6.095 | 5.440 | 4.785 | 4.165 | 3.605 | 3.165 |
| O3 | PPB) | 30.300 | 28.200 | 29.950 | 31.900 | 33.950 | 36.050 | 38.100 |
| H2O2 | PPB) | .007 | .007 | .006 | .006 | .006 | .006 | .007 |
| HNO3 | PPB) | .612 | 1.705 | 2.970 | 4.290 | 5.560 | 6.690 | 7.590 |
| PAN1 | PPB) | .002 | .056 | .131 | .221 | .318 | .414 | .493 |
| PAN2 | PPB) | .002 | .012 | .033 | .057 | .076 | .088 | .093 |
| C3H8 | PPB) | 2.460 | 2.425 | 2.375 | 2.320 | 2.260 | 2.200 | 2.145 |
| ALKA | PPB) | 3.390 | 3.225 | 3.025 | 2.805 | 2.580 | 2.370 | 2.195 |
| ETHE | PPB) | .009 | .008 | .006 | .005 | .004 | .003 | .003 |
| ALKE | PPB) | .006 | .003 | .002 | .001 | .000 | .000 | .000 |
| AROM | PPB) | .422 | .339 | .256 | .185 | .129 | .089 | .064 |
| HCHO | PPB) | 2.000 | 1.450 | 1.115 | .947 | .875 | .853 | .846 |
| ALD2 | PPB) | .400 | .486 | .556 | .604 | .630 | .640 | .638 |
| KET | PPB) | 1.300 | 1.365 | 1.445 | 1.525 | 1.610 | 1.690 | 1.755 |

Run 4

. PERTURBED HC EQUAL TO 1 PLUS DELTA C TIME BASE LINE CONCS (CLEAN D

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | PPB) | 9.300 | 9.015 | 8.690 | 8.440 | 8.325 | 8.235 | 8.170 |
| SO4 | ug/m^3) | 12.000 | 13.100 | 14.400 | 15.400 | 15.900 | 16.250 | 16.550 |
| NO | PPB) | 5.020 | 1.720 | .519 | .053 | .004 | .003 | .003 |
| NO2 | PPB) | 3.000 | 3.270 | 1.495 | .233 | .030 | .030 | .032 |
| O3 | PPB) | 30.300 | 44.100 | 59.150 | 67.450 | 67.650 | 67.050 | 66.700 |
| H2O2 | PPB) | .007 | .020 | .099 | .564 | .898 | .948 | .962 |
| HNO3 | PPB) | .612 | 2.300 | 3.505 | 3.840 | 3.840 | 3.830 | 3.820 |
| PAN1 | PPB) | .002 | .812 | 2.115 | 3.235 | 3.455 | 3.485 | 3.500 |
| PAN2 | PPB) | .002 | .086 | .222 | .299 | .303 | .290 | .277 |
| C3H8 | PPB) | 12.300 | 11.800 | 11.300 | 10.900 | 10.700 | 10.550 | 10.450 |
| ALKA | PPB) | 17.000 | 14.950 | 12.850 | 11.450 | 10.850 | 10.400 | 9.995 |
| ETHE | PPB) | .043 | .031 | .022 | .016 | .014 | .012 | .011 |
| ALKE | PPB) | .103 | .033 | .008 | .002 | .001 | .001 | .000 |
| AROM | PPB) | .843 | .486 | .255 | .152 | .120 | .099 | .085 |
| HCHO | PPB) | 10.000 | 6.225 | 4.160 | 2.925 | 1.955 | 1.335 | .994 |
| ALD2 | PPB) | 2.000 | 2.800 | 3.090 | 2.990 | 2.600 | 2.235 | 2.020 |
| KET | PPB) | 6.530 | 7.380 | 8.210 | 8.695 | 8.695 | 8.615 | 8.550 |

Run 5

PERTURBED NO EQUALS TO 2 TIMES BASE LINE CONC (DIRTY DAY, JULY 3

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 1.140 | 1.135 | 1.120 | 1.105 | 1.085 | 1.065 | 1.040 |
| SO4 | ug/m^3) | 64.000 | 64.000 | 64.100 | 64.150 | 64.200 | 64.300 | 64.400 |
| NO | PPB) | 18.100 | 7.155 | 6.025 | 4.740 | 3.480 | 2.395 | 1.585 |
| NO2 | PPB) | 13.000 | 20.550 | 17.600 | 14.550 | 11.500 | 8.770 | 6.585 |
| O3 | PPB) | 79.900 | 72.650 | 76.550 | 80.750 | 85.600 | 91.800 | 98.100 |
| H2O2 | PPB) | .007 | .007 | .007 | .007 | .008 | .010 | .015 |
| HNO3 | PPB) | 4.030 | 6.670 | 9.805 | 13.100 | 16.300 | 19.050 | 21.150 |
| PAN1 | PPB) | .002 | .520 | 1.160 | 1.875 | 2.620 | 3.370 | 4.050 |
| PAN2 | PPB) | .002 | .047 | .163 | .317 | .469 | .595 | .676 |
| C3H8 | PPB) | 5.050 | 4.995 | 4.915 | 4.825 | 4.710 | 4.585 | 4.465 |
| ALKA | (PPB) | 17.400 | 16.750 | 15.950 | 14.950 | 13.950 | 12.800 | 11.800 |
| ETHE | (PPB) | .009 | .008 | .007 | .006 | .005 | .004 | .003 |
| ALKE | (PPB) | .006 | .003 | .002 | .001 | .000 | .000 | .000 |
| AROM | (PPB) | 2.040 | 1.750 | 1.420 | 1.090 | .798 | .561 | .394 |
| HCHO | (PPB) | 3.400 | 2.735 | 2.380 | 2.255 | 2.255 | 2.310 | 2.355 |
| ALD2 | (PPB) | 4.900 | 4.645 | 4.355 | 4.060 | 3.780 | 3.530 | 3.315 |
| KET | (PPB) | 2.000 | 2.250 | 2.570 | 2.955 | 3.370 | 3.800 | 4.190 |

Run 6

. PERTURBED HC EQUAL 1 PLUS DELTA C TIMES BASE LINE CONC (DIRTY DAY,

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | PPB) | 1.140 | 1.130 | 1.110 | 1.100 | 1.090 | 1.080 | 1.080 |
| SO4 | ug/m^3) | 64.000 | 64.100 | 64.100 | 64.200 | 64.200 | 64.200 | 64.300 |
| NO | PPB) | 9.040 | 2.845 | .913 | .019 | .001 | .000 | .000 |
| NO2 | PPB) | 13.000 | 11.850 | 5.220 | .190 | .038 | .034 | .027 |
| O3 | PPB) | 79.900 | 99.800 | 128.500 | 145.500 | 143.500 | 141.500 | 140.500 |
| H2O2 | PPB) | .007 | .018 | .095 | .879 | .961 | .920 | .888 |
| HNO3 | PPB) | 4.030 | 6.520 | 8.575 | 9.170 | 9.145 | 9.115 | 9.090 |
| PAN1 | PPB) | .002 | 3.840 | 8.930 | 13.150 | 13.250 | 13.250 | 13.350 |
| PAN2 | PPB) | .002 | .160 | .579 | .991 | 1.050 | 1.060 | 1.045 |
| C3H8 | PPB) | 25.300 | 24.850 | 24.300 | 23.850 | 23.650 | 23.450 | 23.300 |
| ALKA | PPB) | 86.800 | 82.450 | 76.850 | 72.250 | 70.300 | 68.600 | 67.300 |
| ETHE | PPB) | .044 | .038 | .032 | .027 | .025 | .023 | .022 |
| ALKE | PPB) | .105 | .046 | .016 | .005 | .002 | .001 | .000 |
| AROM | PPB) | 4.090 | 3.285 | 2.435 | 1.865 | 1.665 | 1.500 | 1.380 |
| HCHO | PPB) | 17.000 | 13.200 | 10.650 | 8.135 | 5.505 | 3.845 | 2.825 |
| ALD2 | PPB) | 24.500 | 22.850 | 21.000 | 19.150 | 16.850 | 14.900 | 13.550 |
| KET | PPB) | 10.000 | 11.750 | 14.050 | 15.600 | 15.500 | 15.400 | 15.200 |

: PERTURBED HC EQUAL TO 1 + 0.5 TIMES BASE LINE CONC RUN (CLEAN DAY, JUNE 28)



| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 9.300 | 9.095 | 8.815 | 8.460 | 8.005 | 7.650 | 7.445 |
| SO4 | (ug/m^3) | 12.000 | 12.800 | 13.950 | 15.350 | 17.150 | 18.550 | 19.400 |
| NO | (PPB) | 5.020 | 2.790 | 1.835 | .966 | .326 | .096 | .045 |
| NO2 | (PPB) | 3.000 | 3.645 | 2.785 | 1.790 | .839 | .319 | .169 |
| O3 | (PPB) | 30.300 | 33.350 | 39.000 | 45.700 | 53.500 | 58.250 | 60.000 |
| H2O2 | (PPB) | .007 | .008 | .010 | .023 | .135 | .487 | .855 |
| HNO3 | (PPB) | .612 | 1.840 | 3.210 | 4.530 | 5.460 | 5.785 | 5.845 |
| PAN1 | (PPB) | .003 | .166 | .439 | .834 | 1.375 | 1.770 | 1.915 |
| PAN2 | (PPB) | .003 | .038 | .110 | .176 | .219 | .224 | .213 |
| C3H8 | (PPB) | 3.700 | 3.595 | 3.450 | 3.275 | 3.050 | 2.880 | 2.780 |
| ALKA | (PPB) | 5.110 | 4.660 | 4.110 | 3.475 | 2.780 | 2.310 | 2.070 |
| ETHE | (PPB) | .013 | .010 | .007 | .005 | .003 | .002 | .001 |
| ALKE | (PPB) | .009 | .004 | .001 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | .634 | .427 | .248 | .119 | .046 | .020 | .013 |
| HCHO | (PPB) | 3.000 | 2.080 | 1.605 | 1.400 | 1.290 | 1.120 | .965 |
| ALD2 | (PPB) | .602 | .796 | .915 | .945 | .888 | .796 | .725 |
| KET | (PPB) | 1.950 | 2.140 | 2.360 | 2.620 | 2.875 | 3.020 | 3.060 |
| HONO | (PPB) | .005 | .079 | .071 | .055 | .024 | .006 | .002 |
| RNO3 | (PPB) | .002 | .091 | .196 | .304 | .401 | .448 | .462 |
| ROOH | (PPB) | .004 | .004 | .005 | .010 | .050 | .201 | .420 |
| CRES | (PPB) | .002 | .020 | .018 | .010 | .004 | .002 | .001 |
| DIAL | (PPB) | .003 | .105 | .104 | .065 | .029 | .013 | .007 |
| MGLY | (PPB) | .003 | .079 | .084 | .060 | .032 | .018 | .014 |
| HO2 | (PPB) | .007 | .002 | .003 | .008 | .023 | .032 | .030 |
| RO2S | (ug/m^3) | .010 | .002 | .004 | .010 | .031 | .058 | .071 |
| RO2L | (ug/m^3) | .010 | .001 | .001 | .002 | .004 | .006 | .008 |
| RAO2 | (ug/m^3) | .010 | .001 | .002 | .004 | .013 | .020 | .022 |
| KO2 | (ug/m^3) | .010 | .000 | .000 | .000 | .002 | .004 | .005 |
| RCO3 | (ug/m^3) | .010 | .001 | .002 | .004 | .012 | .024 | .035 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

PERTURBED CH EQUAL TO 1 PLUS 0.5 TIMES BASE LINE CONC RUN (DIRTY DAY, JULY 3 )

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 1.140 | 1.130 | 1.110 | 1.085 | 1.045 | 1.020 | 1.005 |
| SO4 | (ug/m^3) | 64.000 | 64.100 | 64.100 | 64.250 | 64.400 | 64.500 | 64.550 |
| NO | (PPB) | 9.040 | 4.120 | 2.700 | 1.285 | .278 | .014 | .005 |
| NO2 | (PPB) | 13.000 | 13.750 | 9.940 | 5.620 | 1.640 | .138 | .074 |
| O3 | (PPB) | 79.900 | 83.450 | 94.050 | 108.500 | 123.500 | 128.000 | 128.000 |
| H2O2 | (PPB) | .007 | .008 | .011 | .031 | .245 | .819 | .931 |
| HNO3 | (PPB) | 4.030 | 6.640 | 9.630 | 12.450 | 14.100 | 14.300 | 14.300 |
| PAN1 | (PPB) | .003 | 1.145 | 2.720 | 4.825 | 7.350 | 8.610 | 8.735 |
| PAN2 | (PPB) | .003 | .116 | .420 | .842 | 1.235 | 1.365 | 1.335 |
| C3H8 | (PPB) | 7.610 | 7.485 | 7.305 | 7.050 | 6.730 | 6.520 | 6.400 |
| ALKA | (PPB) | 26.000 | 24.750 | 22.950 | 20.550 | 17.750 | 16.000 | 15.150 |
| ETHE | (PPB) | .013 | .011 | .009 | .007 | .005 | .004 | .003 |
| ALKE | (PPB) | .009 | .004 | .001 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | 3.080 | 2.475 | 1.790 | 1.120 | .600 | .388 | .306 |
| HCHO | (PPB) | 5.110 | 4.105 | 3.625 | 3.460 | 3.250 | 2.590 | 1.905 |
| ALD2 | (PPB) | 7.330 | 6.840 | 6.260 | 5.620 | 4.950 | 4.225 | 3.555 |
| KET | (PPB) | 3.000 | 3.535 | 4.270 | 5.235 | 6.300 | 6.760 | 6.790 |
| HONO | (PPB) | .005 | .069 | .066 | .048 | .016 | .001 | .000 |
| RNO3 | (PPB) | .002 | .255 | .604 | 1.040 | 1.470 | 1.645 | 1.660 |
| ROOH | (PPB) | .004 | .005 | .007 | .020 | .172 | 1.177 | 2.720 |
| CRES | (PPB) | .002 | .065 | .081 | .065 | .040 | .028 | .023 |
| DIAL | (PPB) | .003 | .356 | .498 | .455 | .305 | .178 | .107 |
| MGLY | (PPB) | .003 | .245 | .348 | .341 | .253 | .156 | .103 |
| HO2O | (PPB) | .007 | .002 | .004 | .010 | .034 | .030 | .014 |
| RO2S | (ug/m^3) | .010 | .003 | .006 | .017 | .073 | .270 | .374 |
| RO2L | (ug/m^3) | .010 | .001 | .002 | .006 | .020 | .094 | .192 |
| RAO2 | (ug/m^3) | .010 | .002 | .005 | .013 | .058 | .259 | .553 |
| KO2O | (ug/m^3) | .010 | .000 | .000 | .001 | .003 | .017 | .037 |
| RCO3 | (ug/m^3) | .010 | .001 | .003 | .009 | .038 | .303 | .745 |
| NH3O | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 8

Run 9

NO, NO2 CONC SET AT 2.5, 1.5 PPB RESPECTIVELY (CLEAN DAY, JUNE 28

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 9.300 | 8.955 | 8.475 | 8.030 | 7.755 | 7.565 | 7.415 |
| SO4 | (ug/m^3) | 12.000 | 13.350 | 15.300 | 17.050 | 18.150 | 18.950 | 19.500 |
| NO | (PPB) | 2.470 | 1.028 | .377 | .097 | .034 | .022 | .023 |
| NO2 | (PPB) | 1.480 | 1.560 | .791 | .273 | .109 | .073 | .078 |
| O3 | (PPB) | 30.300 | 35.450 | 42.800 | 48.050 | 49.600 | 49.950 | 50.150 |
| H2O2 | (PPB) | .007 | .016 | .088 | .463 | .961 | 1.365 | 1.640 |
| HNO3 | (PPB) | .612 | 1.580 | 2.465 | 2.830 | 2.905 | 2.920 | 2.925 |
| PAN1 | (PPB) | .002 | .206 | .586 | .946 | 1.090 | 1.135 | 1.125 |
| PAN2 | (PPB) | .002 | .052 | .127 | .158 | .155 | .145 | .133 |
| C3H8 | (PPB) | 2.460 | 2.345 | 2.190 | 2.040 | 1.950 | 1.890 | 1.845 |
| ALKA | (PPB) | 3.390 | 2.910 | 2.325 | 1.865 | 1.620 | 1.465 | 1.355 |
| ETHE | (PPB) | .009 | .006 | .003 | .002 | .001 | .001 | .001 |
| ALKE | (PPB) | .006 | .002 | .000 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | .422 | .216 | .082 | .031 | .017 | .011 | .008 |
| HCHO | (PPB) | 2.000 | 1.430 | 1.185 | .982 | .778 | .626 | .544 |
| ALD2 | (PPB) | .400 | .581 | .628 | .572 | .498 | .438 | .402 |
| KET | (PPB) | 1.300 | 1.510 | 1.745 | 1.905 | 1.955 | 1.965 | 1.970 |
| HONO | (PPB) | .005 | .052 | .030 | .006 | .001 | .001 | .001 |
| RNO3 | (PPB) | .002 | .097 | .198 | .258 | .278 | .284 | .286 |
| ROOH | (PPB) | .004 | .007 | .030 | .162 | .420 | .727 | .993 |
| CRES | (PPB) | .002 | .014 | .007 | .003 | .001 | .001 | .001 |
| DIAL | (PPB) | .003 | .081 | .049 | .020 | .010 | .005 | .004 |
| MGLY | (PPB) | .003 | .067 | .048 | .023 | .015 | .013 | .011 |
| HO2 | (PPB) | .007 | .007 | .019 | .034 | .035 | .032 | .028 |
| RO2S | (ug/m^3) | .010 | .007 | .022 | .051 | .077 | .085 | .078 |
| RO2L | (ug/m^3) | .010 | .002 | .004 | .006 | .009 | .010 | .009 |
| RAO2 | (ug/m^3) | .010 | .003 | .009 | .018 | .024 | .025 | .021 |
| KO2 | (ug/m^3) | .010 | .000 | .001 | .003 | .004 | .005 | .004 |
| RCO3 | (ug/m^3) | .010 | .003 | .008 | .019 | .034 | .041 | .040 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 10

NO, NO2 CONC. SET AT 1.4, 0.8 PPB RESPECTIVELY (CLEAN DAY, JUNE 28

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 9.300 | 8.850 | 8.465 | 8.230 | 8.055 | 7.910 | 7.785 |
| SO4 | (ug/m^3) | 12.000 | 13.800 | 15.300 | 16.300 | 16.950 | 17.550 | 18.000 |
| NO | (PPB) | 1.380 | .333 | .084 | .023 | .011 | .013 | .016 |
| NO2 | (PPB) | .791 | .673 | .220 | .069 | .035 | .043 | .053 |
| O3 | (PPB) | 30.300 | 37.250 | 42.100 | 43.250 | 43.250 | 43.050 | 43.050 |
| H2O2 | (PPB) | .007 | .094 | .446 | .914 | 1.280 | 1.555 | 1.755 |
| HNO3 | (PPB) | .612 | 1.265 | 1.525 | 1.570 | 1.580 | 1.580 | 1.585 |
| PAN1 | (PPB) | .002 | .307 | .631 | .766 | .803 | .798 | .787 |
| PAN2 | (PPB) | .002 | .077 | .139 | .149 | .144 | .132 | .121 |
| C3H8 | (PPB) | 2.460 | 2.315 | 2.185 | 2.105 | 2.050 | 2.000 | 1.965 |
| ALKA | (PPB) | 3.390 | 2.775 | 2.315 | 2.070 | 1.900 | 1.760 | 1.650 |
| ETHE | (PPB) | .009 | .005 | .003 | .002 | .002 | .002 | .001 |
| ALKE | (PPB) | .006 | .001 | .000 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | .422 | .176 | .080 | .049 | .034 | .024 | .019 |
| HCHO | (PPB) | 2.000 | 1.385 | 1.060 | .782 | .574 | .446 | .398 |
| ALD2 | (PPB) | .400 | .597 | .598 | .530 | .453 | .394 | .370 |
| KET | (PPB) | 1.300 | 1.565 | 1.730 | 1.785 | 1.795 | 1.790 | 1.795 |
| HONO | (PPB) | .005 | .022 | .004 | .001 | .000 | .000 | .000 |
| RNO3 | (PPB) | .002 | .120 | .192 | .217 | .227 | .230 | .235 |
| ROOH | (PPB) | .004 | .031 | .163 | .447 | .826 | 1.200 | 1.475 |
| CRES | (PPB) | .002 | .012 | .007 | .004 | .003 | .002 | .002 |
| DIAL | (PPB) | .003 | .079 | .044 | .024 | .014 | .009 | .006 |
| MGLY | (PPB) | .003 | .069 | .043 | .026 | .019 | .016 | .013 |
| HO2 | (PPB) | .007 | .020 | .032 | .033 | .030 | .028 | .025 |
| RO2S | (ug/m^3) | .010 | .022 | .049 | .084 | .100 | .100 | .082 |
| RO2L | (ug/m^3) | .010 | .006 | .009 | .014 | .016 | .015 | .011 |
| RAO2 | (ug/m^3) | .010 | .010 | .020 | .033 | .039 | .037 | .027 |
| KO2 | (ug/m^3) | .010 | .001 | .002 | .004 | .005 | .006 | .004 |
| RCO3 | (ug/m^3) | .010 | .008 | .019 | .042 | .056 | .058 | .044 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 11

NO, NOX CONC SET AT 1.0, 0.5 PPB RESPECTIVELY (CLEAN DAY, JUNE 28)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 9.300 | 8.875 | 8.595 | 8.410 | 8.270 | 8.135 | 8.025 |
| SO4 | (ug/m^3) | 12.000 | 13.700 | 14.800 | 15.500 | 16.150 | 16.650 | 17.100 |
| NO | (PPB) | .988 | .183 | .044 | .011 | .008 | .010 | .013 |
| NO2 | (PPB) | .498 | .405 | .117 | .035 | .024 | .032 | .039 |
| O3 | (PPB) | 30.300 | 36.550 | 39.450 | 39.750 | 39.450 | 39.150 | 39.150 |
| H2O2 | (PPB) | .007 | .191 | .604 | 1.003 | 1.290 | 1.505 | 1.680 |
| HNO3 | (PPB) | .612 | 1.025 | 1.135 | 1.150 | 1.150 | 1.150 | 1.155 |
| PAN1 | (PPB) | .002 | .298 | .523 | .600 | .613 | .606 | .597 |
| PAN2 | (PPB) | .002 | .075 | .123 | .132 | .125 | .116 | .107 |
| C3H8 | (PPB) | 2.460 | 2.320 | 2.225 | 2.165 | 2.120 | 2.075 | 2.035 |
| ALKA | (PPB) | 3.390 | 2.805 | 2.455 | 2.260 | 2.105 | 1.970 | 1.865 |
| ETHE | (PPB) | .009 | .005 | .004 | .003 | .003 | .002 | .002 |
| ALKE | (PPB) | .006 | .001 | .000 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | .422 | .185 | .104 | .072 | .053 | .040 | .031 |
| HCHO | (PPB) | 2.000 | 1.355 | .989 | .694 | .488 | .376 | .336 |
| ALD2 | (PPB) | .400 | .583 | .576 | .503 | .424 | .372 | .352 |
| KET | (PPB) | 1.300 | 1.545 | 1.660 | 1.685 | 1.685 | 1.680 | 1.685 |
| HONO | (PPB) | .005 | .010 | .002 | .000 | .000 | .000 | .000 |
| RNO3 | (PPB) | .002 | .112 | .164 | .181 | .187 | .192 | .197 |
| ROOH | (PPB) | .004 | .064 | .249 | .594 | 1.014 | 1.390 | 1.660 |
| CRES | (PPB) | .002 | .013 | .008 | .006 | .005 | .003 | .003 |
| DIAL | (PPB) | .003 | .078 | .049 | .028 | .017 | .011 | .009 |
| MGLY | (PPB) | .003 | .067 | .044 | .028 | .021 | .017 | .014 |
| HO2 | (PPB) | .007 | .026 | .032 | .030 | .027 | .026 | .024 |
| RO2S | (ug/m^3) | .010 | .031 | .059 | .099 | .109 | .102 | .083 |
| RO2L | (ug/m^3) | .010 | .009 | .013 | .020 | .020 | .017 | .013 |
| RAO2 | (ug/m^3) | .010 | .014 | .025 | .044 | .050 | .044 | .032 |
| KO2 | (ug/m^3) | .010 | .001 | .002 | .005 | .006 | .006 | .004 |
| RCO3 | (ug/m^3) | .010 | .011 | .026 | .058 | .069 | .062 | .046 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 12

NO, NO2 CONC SET AT 0.7, 0.4 PPB RESPECTIVELY (CLEAN DAY, JUNE 28)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 9.300 | 8.925 | 8.695 | 8.545 | 8.410 | 8.290 | 8.185 |
| SO4 | (ug/m^3) | 12.000 | 13.500 | 14.400 | 15.000 | 15.550 | 16.050 | 16.400 |
| NO | (PPB) | .699 | .124 | .028 | .006 | .006 | .008 | .010 |
| NO2 | (PPB) | .398 | .283 | .074 | .020 | .020 | .025 | .031 |
| O3 | (PPB) | 30.300 | 35.600 | 37.450 | 37.400 | 37.000 | 36.700 | 36.600 |
| H2O2 | (PPB) | .007 | .261 | .678 | 1.023 | 1.255 | 1.445 | 1.595 |
| HNO3 | (PPB) | .612 | .883 | .942 | .947 | .947 | .947 | .949 |
| PAN1 | (PPB) | .002 | .261 | .430 | .480 | .483 | .478 | .470 |
| PAN2 | (PPB) | .002 | .065 | .106 | .113 | .107 | .100 | .092 |
| C3H8 | (PPB) | 2.460 | 2.340 | 2.260 | 2.215 | 2.165 | 2.125 | 2.095 |
| ALKA | (PPB) | 3.390 | 2.870 | 2.585 | 2.405 | 2.255 | 2.125 | 2.020 |
| ETHE | (PPB) | .009 | .006 | .004 | .004 | .003 | .003 | .002 |
| ALKE | (PPB) | .006 | .001 | .001 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | .422 | .204 | .130 | .095 | .072 | .055 | .044 |
| HCHO | (PPB) | 2.000 | 1.335 | .951 | .644 | .440 | .336 | .295 |
| ALD2 | (PPB) | .400 | .564 | .553 | .477 | .400 | .352 | .334 |
| KET | (PPB) | 1.300 | 1.510 | 1.595 | 1.605 | 1.605 | 1.600 | 1.605 |
| HONO | (PPB) | .005 | .006 | .001 | .000 | .000 | .000 | .000 |
| RNO3 | (PPB) | .002 | .098 | .139 | .152 | .157 | .162 | .168 |
| ROOH | (PPB) | .004 | .090 | .307 | .688 | 1.125 | 1.505 | 1.770 |
| CRES | (PPB) | .002 | .013 | .010 | .008 | .006 | .005 | .004 |
| DIAL | (PPB) | .003 | .076 | .052 | .031 | .018 | .013 | .010 |
| MGLY | (PPB) | .003 | .063 | .044 | .029 | .021 | .017 | .015 |
| HO2 | (PPB) | .007 | .028 | .031 | .027 | .025 | .024 | .022 |
| RO2S | (ug/m^3) | .010 | .035 | .067 | .106 | .113 | .102 | .084 |
| RO2L | (ug/m^3) | .010 | .010 | .017 | .024 | .023 | .019 | .014 |
| RAO2 | (ug/m^3) | .010 | .017 | .030 | .053 | .059 | .050 | .036 |
| KO2 | (ug/m^3) | .010 | .001 | .003 | .005 | .006 | .006 | .004 |
| RCO3 | (ug/m^3) | .010 | .013 | .032 | .071 | .078 | .063 | .047 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 13

NO, NO2 CONC. SET AT 4.5, 6.5 PPB RESPECTIVELY (DIRTY DAY, JULY 3

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 1.140 | 1.120 | 1.085 | 1.050 | 1.025 | 1.005 | .990 |
| SO4 | (ug/m^3) | 64.000 | 64.100 | 64.200 | 64.400 | 64.500 | 64.550 | 64.600 |
| NO | (PPB) | 4.500 | 1.600 | .518 | .023 | .003 | .003 | .004 |
| NO2 | (PPB) | 6.530 | 5.715 | 2.320 | .159 | .046 | .051 | .062 |
| O3 | (PPB) | 79.900 | 86.400 | 99.050 | 106.500 | 105.500 | 103.500 | 103.000 |
| H2O2 | (PPB) | .007 | .013 | .081 | .653 | .801 | .794 | .796 |
| HNO3 | (PPB) | 4.030 | 6.010 | 7.825 | 8.335 | 8.305 | 8.265 | 8.240 |
| PAN1 | (PPB) | .002 | 1.275 | 3.200 | 4.835 | 4.995 | 5.060 | 5.100 |
| PAN2 | (PPB) | .002 | .156 | .542 | .825 | .824 | .794 | .763 |
| C3H8 | (PPB) | 5.050 | 4.915 | 4.700 | 4.490 | 4.365 | 4.255 | 4.165 |
| ALKA | (PPB) | 17.400 | 15.950 | 13.850 | 11.950 | 11.000 | 10.145 | 9.450 |
| ETHE | (PPB) | .009 | .007 | .005 | .003 | .003 | .002 | .002 |
| ALKE | (PPB) | .006 | .002 | .000 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | 2.040 | 1.420 | .781 | .420 | .290 | .204 | .153 |
| HCHO | (PPB) | 3.400 | 2.875 | 2.665 | 2.175 | 1.360 | .914 | .719 |
| ALD2 | (PPB) | 4.900 | 4.415 | 3.815 | 3.150 | 2.285 | 1.700 | 1.420 |
| KET | (PPB) | 2.000 | 2.590 | 3.435 | 4.060 | 4.080 | 4.065 | 4.080 |
| HONO | (PPB) | .005 | .046 | .027 | .002 | .000 | .000 | .000 |
| RNO3 | (PPB) | .002 | .273 | .646 | .900 | .906 | .900 | .908 |
| ROOH | (PPB) | .004 | .008 | .049 | .666 | 2.465 | 4.150 | 5.470 |
| CRES | (PPB) | .002 | .055 | .050 | .032 | .023 | .017 | .013 |
| DIAL | (PPB) | .003 | .322 | .337 | .201 | .091 | .046 | .033 |
| MGLY | (PPB) | .003 | .234 | .270 | .174 | .092 | .064 | .055 |
| HO2 | (PPB) | .007 | .005 | .021 | .038 | .012 | .010 | .012 |
| RO2S | (ug/m^3) | .010 | .008 | .034 | .188 | .374 | .387 | .341 |
| RO2L | (ug/m^3) | .010 | .003 | .012 | .063 | .230 | .269 | .210 |
| RAO2 | (ug/m^3) | .010 | .006 | .027 | .166 | .835 | 1.054 | .771 |
| KO2 | (ug/m^3) | .010 | .000 | .001 | .008 | .047 | .063 | .049 |
| RCO3 | (ug/m^3) | .010 | .004 | .017 | .157 | 1.045 | 1.076 | .717 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 14

NO, NOX CONC. SET AT 2.7, 3.9 PPB RESPECTIVELY (DIRTY DAY, JULY 3 )

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 1.140 | 1.115 | 1.080 | 1.060 | 1.045 | 1.025 | 1.015 |
| SO4 | (ug/m^3) | 64.000 | 64.100 | 64.200 | 64.300 | 64.400 | 64.500 | 64.500 |
| NO | (PPB) | 2.700 | .596 | .029 | .001 | .001 | .001 | .001 |
| NO2 | (PPB) | 4.000 | 2.455 | .182 | .026 | .030 | .030 | .028 |
| O3 | (PPB) | 79.900 | 89.600 | 97.850 | 96.400 | 94.750 | 93.350 | 92.400 |
| H2O2 | (PPB) | .007 | .051 | .533 | .669 | .642 | .609 | .581 |
| HNO3 | (PPB) | 4.030 | 5.405 | 5.915 | 5.895 | 5.865 | 5.835 | 5.815 |
| PAN1 | (PPB) | .002 | 1.685 | 3.400 | 3.555 | 3.610 | 3.670 | 3.715 |
| PAN2 | (PPB) | .002 | .228 | .587 | .623 | .607 | .586 | .567 |
| C3H8 | (PPB) | 5.050 | 4.880 | 4.690 | 4.575 | 4.465 | 4.360 | 4.275 |
| ALKA | (PPB) | 17.400 | 15.550 | 13.700 | 12.750 | 11.800 | 10.950 | 10.250 |
| ETHE | (PPB) | .009 | .007 | .005 | .004 | .003 | .003 | .002 |
| ALKE | (PPB) | .006 | .002 | .000 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | 2.040 | 1.275 | .746 | .544 | .391 | .284 | .219 |
| HCHO | (PPB) | 3.400 | 2.895 | 2.355 | 1.455 | .920 | .631 | .485 |
| ALD2 | (PPB) | 4.900 | 4.285 | 3.605 | 2.670 | 1.915 | 1.415 | 1.145 |
| KET | (PPB) | 2.000 | 2.755 | 3.420 | 3.430 | 3.395 | 3.360 | 3.340 |
| HONO | (PPB) | .005 | .025 | .002 | .000 | .000 | .000 | .000 |
| RNO3 | (PPB) | .002 | .343 | .630 | .642 | .633 | .624 | .622 |
| ROOH | (PPB) | .004 | .030 | .488 | 2.235 | 3.945 | 5.405 | 6.530 |
| CRES | (PPB) | .002 | .060 | .051 | .042 | .032 | .024 | .019 |
| DIAL | (PPB) | .003 | .359 | .297 | .137 | .060 | .031 | .021 |
| MGLY | (PPB) | .003 | .270 | .233 | .111 | .061 | .045 | .040 |
| HO2 | (PPB) | .007 | .016 | .038 | .009 | .005 | .004 | .003 |
| RO2S | (ug/m^3) | .010 | .025 | .150 | .359 | .391 | .392 | .368 |
| RO2L | (ug/m^3) | .010 | .010 | .059 | .306 | .449 | .501 | .487 |
| RAO2 | (ug/m^3) | .010 | .021 | .131 | 1.100 | 1.980 | 2.475 | 2.500 |
| KO2 | (ug/m^3) | .010 | .001 | .005 | .045 | .086 | .113 | .119 |
| RCO3 | (ug/m^3) | .010 | .012 | .112 | 1.495 | 2.085 | 2.100 | 1.850 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 15

NO, NOX CONC. SET AT 2., 3. PPB RESPECTIVELY (DIRTY DAY, JULY 3 )

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 1.140 | 1.110 | 1.090 | 1.070 | 1.055 | 1.035 | 1.025 |
| SO4 | (ug/m^3) | 64.000 | 64.100 | 64.200 | 64.300 | 64.350 | 64.400 | 64.500 |
| NO | (PPB) | 2.000 | .284 | .000 | .001 | .001 | .001 | .000 |
| NO2 | (PPB) | 3.000 | 1.315 | .003 | .022 | .023 | .022 | .019 |
| O3 | (PPB) | 79.900 | 90.050 | 93.350 | 91.650 | 89.950 | 88.550 | 87.600 |
| H2O2 | (PPB) | .007 | .127 | .626 | .630 | .597 | .564 | .535 |
| HNO3 | (PPB) | 4.030 | 5.020 | 5.170 | 5.140 | 5.120 | 5.090 | 5.070 |
| PAN1 | (PPB) | .002 | 1.810 | 2.870 | 2.875 | 2.925 | 2.975 | 3.010 |
| PAN2 | (PPB) | .002 | .250 | .489 | .493 | .480 | .464 | .449 |
| C3H8 | (PPB) | 5.050 | 4.865 | 4.730 | 4.625 | 4.525 | 4.420 | 4.345 |
| ALKA | (PPB) | 17.400 | 15.450 | 14.100 | 13.200 | 12.250 | 11.400 | 10.750 |
| ETHE | (PPB) | .009 | .007 | .005 | .004 | .004 | .003 | .003 |
| ALKE | (PPB) | .006 | .002 | .001 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | 2.040 | 1.240 | .845 | .632 | .463 | .342 | .268 |
| HCHO | (PPB) | 3.400 | 2.845 | 2.055 | 1.265 | .809 | .559 | .428 |
| ALD2 | (PPB) | 4.900 | 4.240 | 3.495 | 2.565 | 1.860 | 1.385 | 1.115 |
| KET | (PPB) | 2.000 | 2.785 | 3.150 | 3.115 | 3.075 | 3.040 | 3.015 |
| HONO | (PPB) | .005 | .013 | .000 | .000 | .000 | .000 | .000 |
| RNO3 | (PPB) | .002 | .354 | .517 | .512 | .504 | .496 | .493 |
| ROOH | (PPB) | .004 | .079 | .991 | 2.745 | 4.330 | 5.670 | 6.705 |
| CRES | (PPB) | .002 | .062 | .057 | .048 | .037 | .029 | .023 |
| DIAL | (PPB) | .003 | .359 | .257 | .114 | .051 | .026 | .017 |
| MGLY | (PPB) | .003 | .272 | .190 | .087 | .050 | .037 | .032 |
| HO2 | (PPB) | .007 | .027 | .018 | .006 | .004 | .003 | .002 |
| RO2S | (ug/m^3) | .010 | .046 | .260 | .362 | .384 | .380 | .354 |
| RO2L | (ug/m^3) | .010 | .019 | .153 | .418 | .579 | .646 | .648 |
| RAO2 | (ug/m^3) | .010 | .038 | .395 | 1.575 | 2.605 | 3.300 | 3.565 |
| KO2 | (ug/m^3) | .010 | .001 | .013 | .057 | .098 | .130 | .146 |
| RCO3 | (ug/m^3) | .010 | .022 | .567 | 2.035 | 2.620 | 2.710 | 2.550 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 16

NO, NOX CONC. SET AT 1.6, 2.4 PPB RESPECTIVELY (DIRTY DAY, JULY 3 )

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 1.140 | 1.110 | 1.095 | 1.080 | 1.060 | 1.045 | 1.030 |
| SO4 | (ug/m^3) | 64.000 | 64.100 | 64.200 | 64.300 | 64.300 | 64.400 | 64.450 |
| NO | (PPB) | 1.600 | .153 | .000 | .001 | .000 | .000 | .000 |
| NO2 | (PPB) | 2.400 | .766 | .006 | .018 | .018 | .018 | .015 |
| O3 | (PPB) | 79.900 | 89.400 | 90.250 | 88.500 | 86.900 | 85.500 | 84.500 |
| H2O2 | (PPB) | .007 | .217 | .600 | .586 | .554 | .522 | .496 |
| HNO3 | (PPB) | 4.030 | 4.750 | 4.795 | 4.775 | 4.750 | 4.725 | 4.705 |
| PAN1 | (PPB) | .002 | 1.780 | 2.415 | 2.425 | 2.470 | 2.515 | 2.545 |
| PAN2 | (PPB) | .002 | .245 | .399 | .403 | .392 | .378 | .367 |
| C3H8 | (PPB) | 5.050 | 4.875 | 4.765 | 4.665 | 4.560 | 4.465 | 4.385 |
| ALKA | (PPB) | 17.400 | 15.450 | 14.450 | 13.500 | 12.600 | 11.750 | 11.150 |
| ETHE | (PPB) | .009 | .007 | .005 | .005 | .004 | .003 | .003 |
| ALKE | (PPB) | .006 | .002 | .001 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | 2.040 | 1.260 | .928 | .701 | .520 | .390 | .309 |
| HCHO | (PPB) | 3.400 | 2.780 | 1.880 | 1.165 | .753 | .524 | .400 |
| ALD2 | (PPB) | 4.900 | 4.225 | 3.420 | 2.530 | 1.850 | 1.385 | 1.115 |
| KET | (PPB) | 2.000 | 2.755 | 2.940 | 2.910 | 2.870 | 2.835 | 2.810 |
| HONO | (PPB) | .005 | .007 | .000 | .000 | .000 | .000 | .000 |
| RNO3 | (PPB) | .002 | .340 | .431 | .426 | .419 | .413 | .410 |
| ROOH | (PPB) | .004 | .146 | 1.330 | 3.015 | 4.510 | 5.780 | 6.755 |
| CRES | (PPB) | .002 | .062 | .060 | .052 | .041 | .032 | .026 |
| DIAL | (PPB) | .003 | .348 | .222 | .099 | .045 | .023 | .015 |
| MGLY | (PPB) | .003 | .261 | .157 | .074 | .043 | .032 | .027 |
| HO2 | (PPB) | .007 | .033 | .012 | .005 | .003 | .002 | .002 |
| RO2S | (ug/m^3) | .010 | .065 | .291 | .359 | .377 | .371 | .344 |
| RO2L | (ug/m^3) | .010 | .027 | .226 | .493 | .672 | .752 | .763 |
| RAO2 | (ug/m^3) | .010 | .055 | .659 | 1.870 | 2.990 | 3.810 | 4.215 |
| KO2 | (ug/m^3) | .010 | .001 | .021 | .061 | .102 | .136 | .155 |
| RCO3 | (ug/m^3) | .010 | .032 | 1.019 | 2.325 | 2.935 | 3.090 | 2.990 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 17

NO, NO2 CONC. SET AT 6.7, 3.5 PPB RESPECTIVELY (CLEAN DAY, JUNE 28

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 9.300 | 9.155 | 8.960 | 8.725 | 8.445 | 8.130 | 7.810 |
| SO4 | (ug/m^3) | 12.000 | 12.600 | 13.350 | 14.300 | 15.400 | 16.650 | 17.950 |
| NO | (PPB) | 6.610 | 4.035 | 3.245 | 2.415 | 1.645 | 1.000 | .567 |
| NO2 | (PPB) | 3.460 | 4.715 | 4.015 | 3.260 | 2.515 | 1.800 | 1.224 |
| O3 | (PPB) | 30.300 | 30.600 | 33.200 | 36.350 | 40.050 | 44.450 | 48.950 |
| H2O2 | (PPB) | .007 | .007 | .007 | .007 | .009 | .018 | .050 |
| HNO3 | (PPB) | .612 | 1.730 | 3.025 | 4.370 | 5.655 | 6.760 | 7.540 |
| PAN1 | (PPB) | .002 | .076 | .187 | .331 | .504 | .709 | .916 |
| PAN2 | (PPB) | .002 | .017 | .048 | .080 | .105 | .119 | .122 |
| C3H8 | (PPB) | 2.460 | 2.415 | 2.345 | 2.270 | 2.180 | 2.075 | 1.970 |
| ALKA | (PPB) | 3.390 | 3.180 | 2.910 | 2.610 | 2.295 | 1.965 | 1.670 |
| ETHE | (PPB) | .009 | .007 | .006 | .004 | .003 | .002 | .001 |
| ALKE | (PPB) | .006 | .003 | .001 | .001 | .000 | .000 | .000 |
| AROM | (PPB) | .422 | .317 | .218 | .136 | .077 | .040 | .020 |
| HCHO | (PPB) | 2.000 | 1.445 | 1.135 | 1.000 | .967 | .980 | .984 |
| ALD2 | (PPB) | .400 | .505 | .582 | .627 | .637 | .617 | .583 |
| KET | (PPB) | 1.300 | 1.385 | 1.490 | 1.610 | 1.740 | 1.855 | 1.960 |
| HONO | (PPB) | .005 | .080 | .083 | .079 | .067 | .050 | .030 |
| RNO3 | (PPB) | .002 | .046 | .097 | .152 | .206 | .253 | .289 |
| ROOH | (PPB) | .004 | .004 | .004 | .004 | .005 | .008 | .017 |
| CRES | (PPB) | .002 | .012 | .013 | .010 | .006 | .003 | .002 |
| DIAL | (PPB) | .003 | .059 | .071 | .058 | .039 | .023 | .012 |
| MGLY | (PPB) | .003 | .043 | .052 | .046 | .033 | .021 | .013 |
| HO2 | (PPB) | .007 | .001 | .001 | .002 | .003 | .006 | .011 |
| RO2S | (ug/m^3) | .010 | .001 | .001 | .002 | .003 | .007 | .012 |
| RO2L | (ug/m^3) | .010 | .000 | .000 | .000 | .001 | .001 | .001 |
| RAO2 | (ug/m^3) | .010 | .000 | .001 | .001 | .001 | .002 | .004 |
| KO2 | (ug/m^3) | .010 | .000 | .000 | .000 | .000 | .000 | .001 |
| RCO3 | (ug/m^3) | .010 | .000 | .001 | .001 | .001 | .003 | .004 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 18

NO, NO2 CONC. SET AT 7.5, 4.5 PPB RESPECTIVELY (CLEAN DAY, JUNE 2

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 9.300 | 9.175 | 9.010 | 8.820 | 8.605 | 8.370 | 8.160 |
| SO4 | (ug/m^3) | 12.000 | 12.500 | 13.150 | 13.900 | 14.750 | 15.650 | 16.550 |
| NO | (PPB) | 7.400 | 4.895 | 4.125 | 3.300 | 2.510 | 1.820 | 1.295 |
| NO2 | (PPB) | 4.440 | 5.625 | 4.920 | 4.195 | 3.490 | 2.840 | 2.310 |
| O3 | (PPB) | 30.300 | 30.200 | 32.300 | 34.650 | 37.250 | 40.200 | 43.200 |
| H2O2 | (PPB) | .007 | .007 | .007 | .006 | .007 | .008 | .011 |
| HNO3 | (PPB) | .612 | 1.745 | 3.055 | 4.420 | 5.735 | 6.895 | 7.805 |
| PAN1 | (PPB) | .002 | .065 | .155 | .267 | .392 | .525 | .650 |
| PAN2 | (PPB) | .002 | .014 | .039 | .067 | .089 | .103 | .108 |
| C3H8 | (PPB) | 2.460 | 2.420 | 2.365 | 2.300 | 2.230 | 2.155 | 2.085 |
| ALKA | (PPB) | 3.390 | 3.205 | 2.985 | 2.730 | 2.470 | 2.215 | 1.995 |
| ETHE | (PPB) | .009 | .007 | .006 | .005 | .004 | .003 | .002 |
| ALKE | (PPB) | .006 | .003 | .002 | .001 | .000 | .000 | .000 |
| AROM | (PPB) | .422 | .331 | .242 | .165 | .107 | .067 | .043 |
| HCHO | (PPB) | 2.000 | 1.445 | 1.125 | .964 | .911 | .905 | .911 |
| ALD2 | (PPB) | .400 | .493 | .567 | .614 | .636 | .636 | .623 |
| KET | (PPB) | 1.300 | 1.375 | 1.460 | 1.560 | 1.660 | 1.755 | 1.835 |
| HONO | (PPB) | .005 | .083 | .087 | .084 | .075 | .062 | .044 |
| RNO3 | (PPB) | .002 | .040 | .084 | .131 | .176 | .218 | .250 |
| ROOH | (PPB) | .004 | .004 | .004 | .004 | .004 | .005 | .006 |
| CRES | (PPB) | .002 | .011 | .014 | .012 | .008 | .005 | .003 |
| DIAL | (PPB) | .003 | .054 | .069 | .062 | .047 | .032 | .021 |
| MGLY | (PPB) | .003 | .038 | .049 | .046 | .037 | .027 | .018 |
| HO2 | (PPB) | .007 | .001 | .001 | .001 | .002 | .002 | .003 |
| RO2S | (ug/m^3) | .010 | .001 | .001 | .001 | .002 | .003 | .004 |
| RO2L | (ug/m^3) | .010 | .000 | .000 | .000 | .000 | .000 | .000 |
| RAO2 | (ug/m^3) | .010 | .000 | .000 | .000 | .001 | .001 | .001 |
| KO2 | (ug/m^3) | .010 | .000 | .000 | .000 | .000 | .000 | .000 |
| RCO3 | (ug/m^3) | .010 | .000 | .000 | .001 | .001 | .001 | .001 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 19

BASE LINE RUN (AS PER MEMO DATED JAN 23, 87) (CLEAN DAY, JUNE 28)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 9.300 | 9.160 | 8.980 | 8.765 | 8.520 | 8.250 | 7.975 |
| SO4 | (ug/m^3) | 12.000 | 12.600 | 13.300 | 14.150 | 15.150 | 16.200 | 17.250 |
| NO | (PPB) | 7.500 | 4.755 | 3.810 | 2.845 | 1.970 | 1.240 | .737 |
| NO2 | (PPB) | 4.510 | 5.690 | 4.905 | 4.050 | 3.175 | 2.345 | 1.650 |
| O3 | (PPB) | 30.300 | 31.300 | 34.650 | 38.350 | 42.450 | 47.300 | 52.050 |
| H2O2 | (PPB) | .007 | .007 | .007 | .007 | .009 | .014 | .032 |
| HNO3 | (PPB) | .612 | 1.895 | 3.360 | 4.860 | 6.275 | 7.490 | 8.370 |
| PAN1 | (PPB) | .002 | .108 | .266 | .465 | .700 | .970 | 1.245 |
| PAN2 | (PPB) | .002 | .023 | .067 | .114 | .152 | .175 | .184 |
| C3H8 | (PPB) | 3.700 | 3.625 | 3.535 | 3.425 | 3.305 | 3.170 | 3.035 |
| ALKA | (PPB) | 5.110 | 4.795 | 4.425 | 4.010 | 3.580 | 3.135 | 2.740 |
| ETHE | (PPB) | .014 | .012 | .010 | .008 | .006 | .004 | .003 |
| ALKE | (PPB) | .009 | .005 | .002 | .001 | .000 | .000 | .000 |
| AROM | (PPB) | .634 | .483 | .340 | .222 | .135 | .077 | .043 |
| HCHO | (PPB) | 3.000 | 2.115 | 1.590 | 1.335 | 1.230 | 1.205 | 1.200 |
| ALD2 | (PPB) | .602 | .751 | .863 | .929 | .951 | .936 | .898 |
| KET | (PPB) | 1.950 | 2.075 | 2.225 | 2.385 | 2.555 | 2.715 | 2.855 |
| HONO | (PPB) | .005 | .090 | .090 | .083 | .070 | .053 | .033 |
| RNO3 | (PPB) | .002 | .065 | .138 | .214 | .288 | .356 | .409 |
| ROOH | (PPB) | .004 | .004 | .004 | .005 | .005 | .007 | .014 |
| CRES | (PPB) | .003 | .018 | .020 | .016 | .011 | .006 | .004 |
| DIAL | (PPB) | .003 | .086 | .105 | .090 | .064 | .041 | .024 |
| MGLY | (PPB) | .003 | .062 | .076 | .068 | .052 | .036 | .023 |
| HO2 | (PPB) | .007 | .001 | .001 | .002 | .003 | .005 | .008 |
| RO2S | (ug/m^3) | .010 | .001 | .001 | .002 | .003 | .006 | .010 |
| RO2L | (ug/m^3) | .010 | .000 | .000 | .001 | .001 | .001 | .001 |
| RAO2 | (ug/m^3) | .010 | .000 | .001 | .001 | .001 | .002 | .004 |
| KO2 | (ug/m^3) | .010 | .000 | .000 | .000 | .000 | .000 | .001 |
| RCO3 | (ug/m^3) | .010 | .000 | .001 | .001 | .002 | .003 | .004 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 20

NO, NOX CONC. SET AT 9.8, 14.7 PPB RESPECTIVELY (DIRTY DAY, JULY

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 1.140 | 1.130 | 1.115 | 1.090 | 1.060 | 1.020 | .988 |
| SO4 | (ug/m^3) | 64.000 | 64.050 | 64.100 | 64.200 | 64.350 | 64.450 | 64.650 |
| NO | (PPB) | 9.770 | 5.020 | 3.855 | 2.575 | 1.400 | .546 | .160 |
| NO2 | (PPB) | 14.700 | 15.850 | 12.650 | 9.165 | 5.695 | 2.690 | .984 |
| O3 | (PPB) | 79.900 | 79.800 | 85.550 | 92.800 | 102.400 | 113.500 | 121.500 |
| H2O2 | (PPB) | .007 | .007 | .008 | .010 | .021 | .104 | .412 |
| HNO3 | (PPB) | 4.030 | 6.675 | 9.790 | 13.000 | 15.900 | 17.850 | 18.600 |
| PAN1 | (PPB) | .002 | .681 | 1.565 | 2.640 | 3.930 | 5.425 | 6.560 |
| PAN2 | (PPB) | .002 | .066 | .234 | .457 | .678 | .845 | .909 |
| C3H8 | (PPB) | 5.050 | 4.975 | 4.875 | 4.735 | 4.560 | 4.345 | 4.155 |
| ALKA | (PPB) | 17.400 | 16.550 | 15.500 | 14.200 | 12.600 | 10.800 | 9.380 |
| ETHE | (PPB) | .009 | .008 | .007 | .005 | .004 | .003 | .002 |
| ALKE | (PPB) | .006 | .003 | .001 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | 2.040 | 1.680 | 1.270 | .865 | .520 | .273 | .150 |
| HCHO | (PPB) | 3.400 | 2.755 | 2.460 | 2.395 | 2.440 | 2.430 | 2.275 |
| ALD2 | (PPB) | 4.900 | 4.600 | 4.245 | 3.875 | 3.500 | 3.120 | 2.770 |
| KET | (PPB) | 2.000 | 2.320 | 2.745 | 3.285 | 3.915 | 4.595 | 5.070 |
| HONO | (PPB) | .005 | .074 | .078 | .073 | .055 | .029 | .008 |
| RNO3 | (PPB) | .002 | .153 | .359 | .605 | .876 | 1.135 | 1.295 |
| ROOH | (PPB) | .004 | .004 | .005 | .006 | .013 | .062 | .306 |
| CRES | (PPB) | .002 | .041 | .054 | .048 | .033 | .019 | .011 |
| DIAL | (PPB) | .003 | .220 | .317 | .309 | .238 | .148 | .084 |
| MGLY | (PPB) | .003 | .150 | .216 | .222 | .185 | .128 | .081 |
| HO2 | (PPB) | .007 | .001 | .002 | .003 | .007 | .020 | .031 |
| RO2S | (ug/m^3) | .010 | .001 | .003 | .005 | .012 | .035 | .084 |
| RO2L | (ug/m^3) | .010 | .001 | .001 | .002 | .003 | .008 | .017 |
| RAO2 | (ug/m^3) | .010 | .001 | .002 | .004 | .008 | .025 | .053 |
| KO2 | (ug/m^3) | .010 | .000 | .000 | .000 | .000 | .002 | .004 |
| RCO3 | (ug/m^3) | .010 | .001 | .001 | .003 | .006 | .017 | .049 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 21

NO, NOX CONC. SET AT 11.0, 16.5 PPB RESPECTIVELY (DIRTY DAY, JULY

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 1.140 | 1.130 | 1.120 | 1.095 | 1.075 | 1.040 | 1.013 |
| SO4 | (ug/m^3) | 64.000 | 64.000 | 64.100 | 64.200 | 64.300 | 64.400 | 64.550 |
| NO | (PPB) | 11.000 | 5.810 | 4.675 | 3.400 | 2.170 | 1.179 | .551 |
| NO2 | (PPB) | 16.500 | 18.100 | 14.900 | 11.550 | 8.180 | 5.130 | 2.830 |
| O3 | (PPB) | 79.900 | 78.850 | 83.400 | 89.400 | 97.300 | 107.000 | 116.000 |
| H2O2 | (PPB) | .007 | .007 | .007 | .008 | .012 | .028 | .105 |
| HNO3 | (PPB) | 4.030 | 6.740 | 9.910 | 13.300 | 16.400 | 18.950 | 20.500 |
| PAN1 | (PPB) | .002 | .617 | 1.390 | 2.310 | 3.345 | 4.500 | 5.625 |
| PAN2 | (PPB) | .002 | .058 | .203 | .395 | .589 | .745 | .836 |
| C3H8 | (PPB) | 5.050 | 4.985 | 4.890 | 4.780 | 4.630 | 4.455 | 4.275 |
| ALKA | (PPB) | 17.400 | 16.650 | 15.700 | 14.600 | 13.200 | 11.700 | 10.305 |
| ETHE | (PPB) | .009 | .008 | .007 | .006 | .004 | .003 | .002 |
| ALKE | (PPB) | .006 | .003 | .001 | .000 | .000 | .000 | .000 |
| AROM | (PPB) | 2.040 | 1.710 | 1.340 | .962 | .637 | .386 | .226 |
| HCHO | (PPB) | 3.400 | 2.740 | 2.415 | 2.325 | 2.355 | 2.405 | 2.400 |
| ALD2 | (PPB) | 4.900 | 4.625 | 4.295 | 3.960 | 3.630 | 3.315 | 3.025 |
| KET | (PPB) | 2.000 | 2.285 | 2.665 | 3.130 | 3.665 | 4.240 | 4.760 |
| HONO | (PPB) | .005 | .077 | .083 | .080 | .067 | .047 | .024 |
| RNO3 | (PPB) | .002 | .139 | .323 | .541 | .778 | 1.013 | 1.205 |
| ROOH | (PPB) | .004 | .004 | .004 | .005 | .008 | .017 | .063 |
| CRES | (PPB) | .002 | .038 | .053 | .050 | .037 | .024 | .014 |
| DIAL | (PPB) | .003 | .204 | .301 | .310 | .259 | .185 | .119 |
| MGLY | (PPB) | .003 | .138 | .201 | .213 | .190 | .146 | .101 |
| HO2 | (PPB) | .007 | .001 | .001 | .002 | .004 | .009 | .017 |
| RO2S | (ug/m^3) | .010 | .001 | .002 | .003 | .006 | .014 | .031 |
| RO2L | (ug/m^3) | .010 | .000 | .001 | .001 | .002 | .003 | .006 |
| RAO2 | (ug/m^3) | .010 | .001 | .001 | .002 | .004 | .010 | .021 |
| KO2 | (ug/m^3) | .010 | .000 | .000 | .000 | .000 | .001 | .001 |
| RCO3 | (ug/m^3) | .010 | .001 | .001 | .002 | .004 | .007 | .016 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 22

BASE LINE RUN (AS PER MEMO DATED : JAN 23, 87) (DIRTY DAY, JUL)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 1.140 | 1.135 | 1.120 | 1.105 | 1.085 | 1.055 | 1.030 |
| SO4 | (ug/m^3) | 64.000 | 64.000 | 64.100 | 64.200 | 64.250 | 64.350 | 64.450 |
| NO | (PPB) | 13.500 | 7.000 | 5.610 | 4.085 | 2.645 | 1.495 | .731 |
| NO2 | (PPB) | 19.500 | 21.950 | 18.450 | 14.550 | 10.650 | 6.985 | 4.065 |
| O3 | (PPB) | 79.900 | 79.350 | 85.650 | 93.700 | 104.000 | 115.000 | 126.500 |
| H2O2 | (PPB) | .007 | .007 | .007 | .008 | .012 | .025 | .075 |
| HNO3 | (PPB) | 4.030 | 6.960 | 10.400 | 14.050 | 17.500 | 20.200 | 22.000 |
| PAN1 | (PPB) | .002 | .822 | 1.855 | 3.075 | 4.455 | 5.970 | 7.445 |
| PAN2 | (PPB) | .002 | .072 | .255 | .508 | .775 | 1.007 | 1.165 |
| C3H8 | (PPB) | 7.490 | 7.405 | 7.290 | 7.135 | 6.955 | 6.740 | 6.525 |
| ALKA | (PPB) | 26.000 | 25.050 | 23.850 | 22.350 | 20.600 | 18.650 | 16.800 |
| ETHE | (PPB) | .014 | .013 | .011 | .009 | .008 | .006 | .005 |
| ALKE | (PPB) | .009 | .005 | .002 | .001 | .000 | .000 | .000 |
| AROM | (PPB) | 3.000 | 2.560 | 2.065 | 1.560 | 1.100 | .726 | .470 |
| HCHO | (PPB) | 5.110 | 4.045 | 3.460 | 3.220 | 3.175 | 3.190 | 3.170 |
| ALD2 | (PPB) | 7.330 | 6.940 | 6.500 | 6.035 | 5.590 | 5.170 | 4.795 |
| KET | (PPB) | 3.000 | 3.380 | 3.880 | 4.490 | 5.180 | 5.925 | 6.610 |
| HONO | (PPB) | .005 | .084 | .089 | .084 | .069 | .049 | .027 |
| RNO3 | (PPB) | .002 | .187 | .432 | .725 | 1.043 | 1.365 | 1.640 |
| ROOH | (PPB) | .004 | .004 | .004 | .005 | .008 | .016 | .050 |
| CRES | (PPB) | .003 | .052 | .073 | .072 | .058 | .040 | .026 |
| DIAL | (PPB) | .003 | .273 | .417 | .448 | .399 | .312 | .222 |
| MGLY | (PPB) | .003 | .183 | .273 | .299 | .278 | .230 | .173 |
| HO2 | (PPB) | .007 | .001 | .001 | .002 | .004 | .007 | .014 |
| RO2S | (ug/m^3) | .010 | .001 | .002 | .003 | .006 | .013 | .027 |
| RO2L | (ug/m^3) | .010 | .000 | .001 | .001 | .002 | .004 | .006 |
| RAO2 | (ug/m^3) | .010 | .001 | .001 | .003 | .005 | .009 | .019 |
| KO2 | (ug/m^3) | .010 | .000 | .000 | .000 | .000 | .000 | .001 |
| RCO3 | (ug/m^3) | .010 | .001 | .001 | .002 | .004 | .007 | .014 |
| NH3 | (PPB) | .014 | .014 | .014 | .014 | .014 | .014 | .014 |
| DUST | (ug/m^3) | .010 | .010 | .010 | .010 | .010 | .010 | .010 |

Run 23

NO, NO2 CONC AT 2.5, 1.5 PPB TEST RUN (CLEAN DAY, JUNE 28 1984)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 8.999 | 8.674 | 8.441 | 8.247 | 8.071 | 7.913 | 7.787 |
| SO4 | (ug/m^3) | 25.000 | 26.286 | 27.229 | 28.014 | 28.700 | 29.314 | 29.843 |
| NO | (PPB) | 0.188 | 0.070 | 0.023 | 0.010 | 0.009 | 0.010 | 0.012 |
| NO2 | (PPB) | 0.562 | 0.226 | 0.081 | 0.036 | 0.035 | 0.039 | 0.045 |
| O3 | (PPB) | 42.200 | 45.243 | 46.029 | 45.757 | 45.229 | 44.829 | 44.614 |
| H2O2 | (PPB) | 1.313 | 1.616 | 2.041 | 2.417 | 2.704 | 2.933 | 3.097 |
| HNO3 | (PPB) | 0.562 | 0.754 | 0.808 | 0.823 | 0.829 | 0.836 | 0.842 |
| PAN1 | (PPB) | 0.002 | 0.194 | 0.299 | 0.329 | 0.321 | 0.307 | 0.291 |
| PAN2 | (PPB) | 0.002 | 0.017 | 0.025 | 0.026 | 0.023 | 0.020 | 0.017 |
| C3H8 | (PPB) | 0.920 | 0.876 | 0.844 | 0.818 | 0.795 | 0.774 | 0.757 |
| ALKA | (PPB) | 2.440 | 2.091 | 1.864 | 1.690 | 1.543 | 1.421 | 1.330 |
| ETHE | (PPB) | 0.009 | 0.006 | 0.005 | 0.004 | 0.003 | 0.002 | 0.002 |
| ALKE | (PPB) | 0.006 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| AROM | (PPB) | 0.094 | 0.049 | 0.030 | 0.020 | 0.014 | 0.010 | 0.007 |
| HCHO | (PPB) | 1.677 | 1.249 | 0.879 | 0.615 | 0.447 | 0.363 | 0.332 |
| ALD2 | (PPB) | 0.375 | 0.430 | 0.395 | 0.330 | 0.272 | 0.238 | 0.226 |
| KET | (PPB) | 1.219 | 1.320 | 1.364 | 1.369 | 1.364 | 1.360 | 1.354 |
| HONO | (PPB) | 0.005 | 0.004 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| RNO3 | (PPB) | 0.002 | 0.059 | 0.086 | 0.099 | 0.105 | 0.110 | 0.115 |
| ROOH | (PPB) | 0.004 | 0.126 | 0.371 | 0.742 | 1.147 | 1.490 | 1.740 |
| CRES | (PPB) | 0.002 | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 |
| DIAL | (PPB) | 0.003 | 0.017 | 0.012 | 0.007 | 0.004 | 0.003 | 0.002 |
| MGLY | (PPB) | 0.003 | 0.016 | 0.014 | 0.013 | 0.013 | 0.012 | 0.010 |
| HO2 | (PPB) | 0.007 | 0.032 | 0.034 | 0.033 | 0.031 | 0.029 | 0.026 |
| RO2S | (ug/m^3) | 0.010 | 0.044 | 0.075 | 0.098 | 0.103 | 0.094 | 0.079 |
| RO2L | (ug/m^3) | 0.010 | 0.004 | 0.006 | 0.007 | 0.007 | 0.006 | 0.005 |
| RAO2 | (ug/m^3) | 0.010 | 0.019 | 0.031 | 0.041 | 0.042 | 0.035 | 0.027 |
| KO2 | (ug/m^3) | 0.010 | 0.002 | 0.003 | 0.005 | 0.006 | 0.005 | 0.004 |
| RCO3 | (ug/m^3) | 0.010 | 0.011 | 0.027 | 0.044 | 0.048 | 0.041 | 0.033 |
| NH3 | (PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | (ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

SARNIA RUN 7 JULY 1984

Run 24

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 2.360 | 2.271 | 2.177 | 2.100 | 2.039 | 1.984 | 1.939 |
| SO4 | (ug/m^3) | 6.000 | 6.349 | 6.720 | 7.011 | 7.257 | 7.466 | 7.633 |
| NO | (PPB) | 0.566 | 0.284 | 0.115 | 0.068 | 0.051 | 0.047 | 0.045 |
| NO2 | (PPB) | 1.227 | 0.637 | 0.337 | 0.218 | 0.174 | 0.164 | 0.166 |
| O3 | (PPB) | 28.300 | 33.700 | 38.343 | 40.957 | 42.586 | 43.771 | 44.757 |
| HCO2 | (PPB) | 0.849 | 0.637 | 1.004 | 1.394 | 1.736 | 2.020 | 2.226 |
| HNO3 | (PPB) | 0.567 | 1.019 | 1.297 | 1.421 | 1.503 | 1.559 | 1.604 |
| PAN1 | (PPB) | 0.002 | 0.328 | 0.501 | 0.521 | 0.488 | 0.437 | 0.386 |
| PAN2 | (PPB) | 0.002 | 0.003 | 0.003 | 0.002 | 0.001 | 0.001 | 0.001 |
| C3H8 | (PPB) | 1.623 | 1.534 | 1.444 | 1.374 | 1.313 | 1.269 | 1.229 |
| ALKA | (PPB) | 2.264 | 1.909 | 1.576 | 1.350 | 1.179 | 1.049 | 0.950 |
| ETHE | (PPB) | 0.009 | 0.006 | 0.004 | 0.003 | 0.002 | 0.002 | 0.001 |
| ALKE | (PPB) | 0.006 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AROM | (PPB) | 0.003 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| HCHO | (PPB) | 1.414 | 1.331 | 1.191 | 1.024 | 0.894 | 0.802 | 0.752 |
| ALD2 | (PPB) | 1.226 | 0.856 | 0.622 | 0.494 | 0.415 | 0.364 | 0.336 |
| KET | (PPB) | 0.472 | 0.638 | 0.777 | 0.857 | 0.909 | 0.943 | 0.966 |
| HONO | (PPB) | 0.005 | 0.017 | 0.006 | 0.003 | 0.002 | 0.002 | 0.001 |
| RNO3 | (PPB) | 0.002 | 0.063 | 0.110 | 0.135 | 0.151 | 0.160 | 0.166 |
| ROOH | (PPB) | 0.004 | 0.030 | 0.146 | 0.355 | 0.593 | 0.818 | 0.995 |
| CRES | (PPB) | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| DIAL | (PPB) | 0.003 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| MGLY | (PPB) | 0.003 | 0.001 | 0.001 | 0.002 | 0.003 | 0.003 | 0.003 |
| HO2 | (PPB) | 0.007 | 0.020 | 0.031 | 0.035 | 0.035 | 0.033 | 0.029 |
| RO2S | (ug/m^3) | 0.010 | 0.026 | 0.048 | 0.063 | 0.066 | 0.065 | 0.057 |
| RO2L | (ug/m^3) | 0.010 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| RAO2 | (ug/m^3) | 0.010 | 0.008 | 0.013 | 0.015 | 0.015 | 0.013 | 0.011 |
| MO2 | (ug/m^3) | 0.010 | 0.000 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 |
| RCO3 | (ug/m^3) | 0.010 | 0.010 | 0.018 | 0.025 | 0.026 | 0.026 | 0.022 |
| NH3 | (PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | (ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

Run 25

SARNIA RUN 8 JULY 1984 (RUN 1)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 10.376 | 10.177 | 10.006 | 9.820 | 9.679 | 9.827 | 9.791 |
| SO4 | (ug/m^3) | 6.000 | 6.634 | 7.623 | 7.971 | 8.169 | 8.337 | 8.467 |
| NO | (PPB) | 2.113 | 0.776 | 0.155 | 0.044 | 0.001 | 0.000 | 0.000 |
| NO2 | (PPB) | 2.023 | 1.720 | 0.544 | 0.121 | 0.012 | 0.011 | 0.009 |
| O3 | (PPB) | 27.571 | 39.471 | 50.429 | 52.600 | 52.229 | 51.671 | 51.300 |
| H2O2 | (PPB) | 0.921 | 0.891 | 1.031 | 1.349 | 1.344 | 1.306 | 1.267 |
| HNO3 | (PPB) | 0.552 | 1.131 | 1.444 | 1.474 | 1.471 | 1.469 | 1.463 |
| PAN1 | (PPB) | 0.002 | 0.405 | 1.250 | 1.659 | 1.673 | 1.684 | 1.697 |
| PAN2 | (PPB) | 0.002 | 0.118 | 0.341 | 0.449 | 0.451 | 0.446 | 0.440 |
| C3H8 | (PPB) | 18.671 | 18.229 | 17.814 | 17.643 | 17.543 | 17.443 | 17.386 |
| ALKA | (PPB) | 35.343 | 32.771 | 30.486 | 29.514 | 28.971 | 28.500 | 28.157 |
| ETHE | (PPB) | 0.008 | 0.007 | 0.006 | 0.005 | 0.005 | 0.005 | 0.004 |
| ALKE | (PPB) | 0.552 | 0.262 | 0.121 | 0.073 | 0.050 | 0.035 | 0.025 |
| AROM | (PPB) | 2.207 | 1.583 | 1.148 | 0.997 | 0.919 | 0.856 | 0.811 |
| HCHO | (PPB) | 3.220 | 2.869 | 2.610 | 2.014 | 1.430 | 1.050 | 0.812 |
| ALD2 | (PPB) | 0.552 | 2.664 | 3.806 | 3.870 | 3.551 | 3.289 | 3.106 |
| KET | (PPB) | 0.460 | 1.681 | 2.720 | 3.023 | 3.017 | 3.004 | 2.989 |
| HONO | (PPB) | 0.005 | 0.023 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 |
| RNO3 | (PPB) | 0.002 | 0.523 | 0.960 | 1.090 | 1.090 | 1.089 | 1.087 |
| ROOH | (PPB) | 0.004 | 0.020 | 0.152 | 0.714 | 1.580 | 2.276 | 2.773 |
| CRES | (PPB) | 0.002 | 0.063 | 0.068 | 0.065 | 0.063 | 0.060 | 0.059 |
| DIAL | (PPB) | 0.003 | 0.334 | 0.357 | 0.267 | 0.172 | 0.114 | 0.079 |
| MGLY | (PPB) | 0.003 | 0.243 | 0.255 | 0.166 | 0.089 | 0.051 | 0.032 |
| HO2 | (PPB) | 0.006 | 0.011 | 0.026 | 0.017 | 0.005 | 0.003 | 0.002 |
| RO2S | (ug/m^3) | 0.010 | 0.019 | 0.061 | 0.203 | 0.309 | 0.321 | 0.301 |
| RO2L | (ug/m^3) | 0.010 | 0.006 | 0.019 | 0.085 | 0.210 | 0.306 | 0.378 |
| RAO2 | (ug/m^3) | 0.010 | 0.020 | 0.059 | 0.290 | 0.974 | 1.547 | 1.971 |
| MO2 | (ug/m^3) | 0.010 | 0.000 | 0.001 | 0.004 | 0.015 | 0.025 | 0.032 |
| RCO3 | (ug/m^3) | 0.010 | 0.006 | 0.022 | 0.258 | 0.965 | 1.373 | 1.641 |
| NH3 | (PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | (ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

Run 26

SARNIA RUN 8 JULY 1984 (RUN 2)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 10.376 | 10.263 | 10.036 | 9.794 | 9.483 | 9.301 | 9.203 |
| SO4 | (g/m^3) | 6.000 | 6.544 | 7.383 | 8.484 | 9.751 | 10.357 | 10.957 |
| NO | (PPB) | 7.351 | 4.383 | 2.709 | 1.230 | 0.309 | 0.036 | 0.005 |
| NO2 | (PPB) | 7.357 | 8.129 | 6.297 | 3.740 | 1.303 | 0.210 | 0.044 |
| O3 | (PPB) | 36.771 | 41.800 | 53.014 | 66.414 | 78.457 | 82.829 | 83.029 |
| H2O2 | (PPB) | 0.921 | 0.875 | 0.821 | 0.777 | 0.878 | 1.279 | 1.473 |
| HNO3 | (PPB) | 0.552 | 2.090 | 4.107 | 5.979 | 7.051 | 7.259 | 7.259 |
| PAN1 | (PPB) | 0.002 | 0.241 | 0.904 | 1.959 | 3.214 | 3.933 | 4.096 |
| PAN2 | (PPB) | 0.002 | 0.197 | 0.824 | 1.719 | 2.556 | 2.919 | 2.950 |
| C3H8 | (PPB) | 3.124 | 3.076 | 3.003 | 2.907 | 2.794 | 2.727 | 2.693 |
| ALKA | (PPB) | 12.857 | 12.229 | 11.329 | 10.229 | 9.043 | 8.351 | 8.034 |
| ETHE | (PPB) | 0.008 | 0.007 | 0.006 | 0.005 | 0.003 | 0.003 | 0.002 |
| ALKE | (PPB) | 0.221 | 0.126 | 0.056 | 0.019 | 0.006 | 0.002 | 0.001 |
| AROM | (PPB) | 7.173 | 5.776 | 4.127 | 2.636 | 1.553 | 1.084 | 0.916 |
| HCHO | (PPB) | 3.220 | 2.549 | 2.281 | 2.179 | 2.010 | 1.644 | 1.264 |
| ALD2 | (PPB) | 0.552 | 1.018 | 1.460 | 1.760 | 1.867 | 1.767 | 1.600 |
| KET | (PPB) | 0.460 | 0.723 | 1.103 | 1.560 | 2.027 | 2.239 | 2.271 |
| HONO | (PPB) | 0.005 | 0.089 | 0.080 | 0.051 | 0.017 | 0.002 | 0.000 |
| RNO3 | (PPB) | 0.002 | 0.138 | 0.347 | 0.593 | 0.815 | 0.907 | 0.919 |
| ROOH | (PPB) | 0.004 | 0.004 | 0.006 | 0.015 | 0.103 | 0.564 | 1.352 |
| CRES | (PPB) | 0.002 | 0.161 | 0.216 | 0.176 | 0.114 | 0.083 | 0.072 |
| DIAL | (PPB) | 0.003 | 0.837 | 1.194 | 1.080 | 0.764 | 0.500 | 0.334 |
| MGLY | (PPB) | 0.003 | 0.589 | 0.865 | 0.832 | 0.625 | 0.396 | 0.240 |
| HO2 | (PPB) | 0.006 | 0.002 | 0.004 | 0.009 | 0.026 | 0.028 | 0.017 |
| RO2S | (g/m^3) | 0.010 | 0.001 | 0.003 | 0.009 | 0.036 | 0.109 | 0.163 |
| RO2L | (g/m^3) | 0.010 | 0.003 | 0.006 | 0.014 | 0.037 | 0.124 | 0.225 |
| RAO2 | (g/m^3) | 0.010 | 0.001 | 0.002 | 0.006 | 0.025 | 0.088 | 0.159 |
| KO2 | (g/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.001 | 0.004 | 0.007 |
| RCO3 | (g/m^3) | 0.010 | 0.001 | 0.003 | 0.008 | 0.026 | 0.168 | 0.352 |
| NH3 | (PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | (g/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

Run 27

SARNIA RUN 14 JULY 1984

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 26.171 | 25.586 | 24.943 | 24.386 | 24.257 | 23.914 | 23.629 |
| SO4 | (ug/m^3) | 54.000 | 56.300 | 58.700 | 60.171 | 61.514 | 62.757 | 63.871 |
| NO | (PPB) | 0.941 | 0.791 | 0.113 | 0.022 | 0.016 | 0.018 | 0.023 |
| NO2 | (PPB) | 9.410 | 4.611 | 1.039 | 0.301 | 0.242 | 0.275 | 0.334 |
| O3 | (PPB) | 75.243 | 96.429 | 114.286 | 118.000 | 119.143 | 120.000 | 121.371 |
| HCO2 | (PPB) | 1.881 | 1.853 | 2.464 | 3.119 | 3.390 | 3.570 | 3.733 |
| HNO3 | (PPB) | 0.565 | 2.644 | 3.671 | 3.834 | 3.901 | 3.961 | 4.030 |
| PAN1 | (PPB) | 0.002 | 1.814 | 3.936 | 4.361 | 4.354 | 4.290 | 4.189 |
| PAN2 | (PPB) | 0.002 | 0.431 | 1.039 | 1.126 | 1.058 | 0.964 | 0.874 |
| C3H6 | (PPB) | 1.413 | 1.364 | 1.317 | 1.286 | 1.254 | 1.234 | 1.207 |
| ALKA | (PPB) | 34.714 | 31.314 | 27.943 | 26.014 | 24.400 | 22.943 | 21.771 |
| ETHE | (PPB) | 0.943 | 0.744 | 0.573 | 0.483 | 0.413 | 0.357 | 0.314 |
| ALKE | (PPB) | 2.167 | 0.649 | 0.162 | 0.052 | 0.018 | 0.006 | 0.003 |
| AROM | (PPB) | 4.896 | 3.224 | 2.043 | 1.540 | 1.199 | 0.951 | 0.782 |
| HCHO | (PPB) | 3.294 | 4.636 | 4.757 | 3.840 | 3.021 | 2.527 | 2.315 |
| ALD2 | (PPB) | 3.857 | 6.104 | 6.490 | 5.784 | 4.994 | 4.400 | 4.049 |
| KET | (PPB) | 8.846 | 10.014 | 11.029 | 11.286 | 11.357 | 11.394 | 11.460 |
| HONO | (PPB) | 0.005 | 0.031 | 0.006 | 0.001 | 0.001 | 0.001 | 0.001 |
| RNO3 | (PPB) | 0.002 | 0.607 | 1.124 | 1.279 | 1.357 | 1.420 | 1.476 |
| ROOH | (PPB) | 0.004 | 0.075 | 0.839 | 3.224 | 5.917 | 8.199 | 9.903 |
| CRES | (PPB) | 0.002 | 0.125 | 0.113 | 0.098 | 0.083 | 0.069 | 0.057 |
| DIAL | (PPB) | 0.003 | 0.819 | 0.773 | 0.509 | 0.329 | 0.228 | 0.174 |
| MGLY | (PPB) | 0.003 | 0.614 | 0.606 | 0.402 | 0.276 | 0.210 | 0.171 |
| HO2 | (PPB) | 0.007 | 0.023 | 0.050 | 0.033 | 0.026 | 0.024 | 0.023 |
| RO2S | (ug/m^3) | 0.010 | 0.039 | 0.158 | 0.343 | 0.380 | 0.363 | 0.320 |
| RO2L | (ug/m^3) | 0.010 | 0.019 | 0.078 | 0.280 | 0.432 | 0.518 | 0.546 |
| RAO2 | (ug/m^3) | 0.010 | 0.031 | 0.122 | 0.628 | 1.233 | 1.723 | 2.004 |
| KO2 | (ug/m^3) | 0.010 | 0.002 | 0.008 | 0.041 | 0.064 | 0.120 | 0.142 |
| RCO3 | (ug/m^3) | 0.010 | 0.019 | 0.122 | 0.920 | 1.517 | 1.812 | 1.886 |
| NH3 | (PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | (ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

## Run 28

SARNIA RUN 16 JULY 1984

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | PPB) | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| SO4 | ug/m^3) | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 | 4.000 |
| NO | PPB) | 1.036 | 0.164 | 0.045 | 0.016 | 0.011 | 0.010 | 0.012 |
| NO2 | PPB) | 0.282 | 0.445 | 0.159 | 0.070 | 0.051 | 0.050 | 0.057 |
| O3 | PPB) | 28.227 | 33.829 | 37.100 | 37.986 | 38.214 | 38.343 | 38.600 |
| H2O2 | PPB) | 0.847 | 0.906 | 1.149 | 1.376 | 1.516 | 1.609 | 1.686 |
| HNO3 | PPB) | 0.565 | 0.826 | 0.908 | 0.927 | 0.934 | 0.940 | 0.945 |
| PAN1 | PPB) | 0.002 | 0.181 | 0.369 | 0.414 | 0.405 | 0.381 | 0.350 |
| PAN2 | PPB) | 0.002 | 0.022 | 0.033 | 0.032 | 0.027 | 0.022 | 0.018 |
| C3H8 | PPB) | 0.207 | 0.198 | 0.193 | 0.189 | 0.185 | 0.182 | 0.180 |
| ALKA | PPB) | 12.614 | 11.071 | 10.069 | 9.459 | 8.953 | 8.529 | 8.201 |
| ETHE | PPB) | 0.009 | 0.007 | 0.005 | 0.005 | 0.004 | 0.004 | 0.003 |
| ALKE | PPB) | 0.006 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| AROM | PPB) | 0.207 | 0.121 | 0.083 | 0.064 | 0.051 | 0.042 | 0.036 |
| HCHO | PPB) | 0.659 | 0.893 | 0.965 | 0.850 | 0.720 | 0.634 | 0.596 |
| ALD2 | PPB) | 0.006 | 1.067 | 1.366 | 1.351 | 1.266 | 1.198 | 1.167 |
| KET | PPB) | 0.003 | 0.614 | 0.944 | 1.088 | 1.173 | 1.240 | 1.297 |
| HONO | PPB) | 0.005 | 0.006 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| RNO3 | PPB) | 0.002 | 0.248 | 0.377 | 0.432 | 0.464 | 0.489 | 0.511 |
| ROOH | PPB) | 0.004 | 0.086 | 0.356 | 0.856 | 1.446 | 1.983 | 2.396 |
| ORES | PPB) | 0.002 | 0.007 | 0.006 | 0.005 | 0.004 | 0.003 | 0.003 |
| DIAL | PPB) | 0.003 | 0.038 | 0.031 | 0.022 | 0.016 | 0.012 | 0.010 |
| MGLY | PPB) | 0.003 | 0.030 | 0.025 | 0.019 | 0.015 | 0.013 | 0.011 |
| HO2 | PPB) | 0.007 | 0.022 | 0.028 | 0.024 | 0.021 | 0.020 | 0.018 |
| RO2S | ug/m^3) | 0.010 | 0.040 | 0.081 | 0.129 | 0.144 | 0.138 | 0.117 |
| RO2L | ug/m^3) | 0.010 | 0.004 | 0.009 | 0.018 | 0.021 | 0.019 | 0.014 |
| RAO2 | ug/m^3) | 0.010 | 0.044 | 0.079 | 0.149 | 0.186 | 0.169 | 0.121 |
| KO2 | ug/m^3) | 0.010 | 0.000 | 0.001 | 0.003 | 0.004 | 0.004 | 0.003 |
| RCO3 | ug/m^3) | 0.010 | 0.012 | 0.040 | 0.099 | 0.128 | 0.118 | 0.090 |
| NH3 | PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

Run 29

SARNIA RUN 17 JULY 1984

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 4.636 | 4.620 | 4.576 | 4.521 | 4.461 | 4.400 | 4.345 |
| SO4 | (ug/m^3) | 5.000 | 5.134 | 5.317 | 5.536 | 5.780 | 6.026 | 6.247 |
| NO | (PPB) | 4.657 | 8.346 | 7.456 | 6.362 | 5.224 | 4.173 | 3.297 |
| NO2 | (PPB) | 18.614 | 13.243 | 12.071 | 10.913 | 9.774 | 8.727 | 7.921 |
| O3 | (PPB) | 27.986 | 33.800 | 35.886 | 38.429 | 41.229 | 44.271 | 47.200 |
| H2O2 | (PPB) | 0.931 | 0.892 | 0.848 | 0.802 | 0.758 | 0.717 | 0.683 |
| HNO3 | (PPB) | 0.039 | 1.976 | 3.739 | 5.680 | 7.624 | 9.407 | 10.831 |
| PAN1 | (PPB) | 0.002 | 0.123 | 0.280 | 0.467 | 0.671 | 0.873 | 1.040 |
| PAN2 | (PPB) | 0.002 | 0.011 | 0.033 | 0.062 | 0.090 | 0.111 | 0.123 |
| C3H6 | (PPB) | 3.817 | 3.783 | 3.731 | 3.673 | 3.606 | 3.537 | 3.480 |
| ALKA | (PPB) | 12.486 | 12.114 | 11.600 | 11.057 | 10.436 | 9.846 | 9.349 |
| ETHE | (PPB) | 0.019 | 0.017 | 0.016 | 0.014 | 0.012 | 0.010 | 0.009 |
| ALKE | (PPB) | 0.186 | 0.126 | 0.078 | 0.044 | 0.024 | 0.013 | 0.007 |
| AROM | (PPB) | 0.708 | 0.623 | 0.523 | 0.422 | 0.334 | 0.263 | 0.212 |
| HCHO | (PPB) | 1.489 | 1.339 | 1.307 | 1.359 | 1.449 | 1.547 | 1.626 |
| ALD2 | (PPB) | 1.490 | 1.697 | 1.693 | 2.050 | 2.154 | 2.213 | 2.237 |
| KET | (PPB) | 3.257 | 3.384 | 3.556 | 3.756 | 3.966 | 4.167 | 4.331 |
| HONO | (PPB) | 0.005 | 0.092 | 0.103 | 0.105 | 0.098 | 0.084 | 0.065 |
| RNO3 | (PPB) | 0.002 | 0.072 | 0.164 | 0.269 | 0.376 | 0.476 | 0.559 |
| ROOH | (PPB) | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| CRES | (PPB) | 0.002 | 0.012 | 0.019 | 0.021 | 0.020 | 0.017 | 0.014 |
| DIAL | (PPB) | 0.003 | 0.038 | 0.091 | 0.103 | 0.099 | 0.087 | 0.074 |
| MGLY | (PPB) | 0.003 | 0.039 | 0.060 | 0.069 | 0.067 | 0.060 | 0.051 |
| HO2 | (PPB) | 0.007 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 |
| RO2S | (ug/m^3) | 0.010 | 0.000 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 |
| RO2L | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| RAO2 | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 |
| NO2 | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| RCO3 | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 |
| NH3 | (PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | (ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

Run 30

SARNIA RUN 18 JULY 1984 RUN 1

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | PPB) | 2.201 | 2.180 | 2.159 | 2.134 | 2.113 | 2.094 | 2.080 |
| SO4 | ug/m^3) | 17.000 | 17.229 | 17.400 | 17.500 | 17.557 | 17.629 | 17.700 |
| NO | PPB) | 0.979 | 0.112 | 0.011 | 0.001 | 0.001 | 0.001 | 0.001 |
| NO2 | PPB) | 0.094 | 0.281 | 0.039 | 0.008 | 0.009 | 0.008 | 0.008 |
| O3 | PPB) | 28.114 | 32.929 | 34.486 | 33.971 | 33.400 | 32.929 | 32.571 |
| H2O2 | PPB) | 0.937 | 1.064 | 1.334 | 1.394 | 1.370 | 1.337 | 1.306 |
| HNO3 | PPB) | 0.562 | 0.743 | 0.776 | 0.775 | 0.772 | 0.770 | 0.768 |
| PAN1 | PPB) | 0.002 | 0.177 | 0.362 | 0.392 | 0.398 | 0.404 | 0.408 |
| PAN2 | PPB) | 0.002 | 0.052 | 0.094 | 0.098 | 0.094 | 0.090 | 0.086 |
| C3H8 | PPB) | 4.687 | 4.531 | 4.449 | 4.391 | 4.334 | 4.289 | 4.250 |
| ALKA | PPB) | 12.114 | 10.886 | 10.229 | 9.817 | 9.443 | 9.116 | 8.876 |
| ETHE | PPB) | 0.008 | 0.006 | 0.005 | 0.005 | 0.004 | 0.004 | 0.004 |
| ALKE | PPB) | 0.094 | 0.036 | 0.019 | 0.012 | 0.007 | 0.005 | 0.003 |
| AROM | PPB) | 0.563 | 0.354 | 0.271 | 0.227 | 0.191 | 0.164 | 0.145 |
| HCHO | PPB) | 0.939 | 0.948 | 0.808 | 0.558 | 0.391 | 0.291 | 0.234 |
| ALD2 | PPB) | 0.005 | 0.905 | 1.084 | 0.941 | 0.797 | 0.697 | 0.640 |
| KET | PPB) | 0.003 | 0.535 | 0.754 | 0.777 | 0.781 | 0.785 | 0.792 |
| HONO | PPB) | 0.005 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| RNO3 | PPB) | 0.002 | 0.231 | 0.323 | 0.332 | 0.331 | 0.332 | 0.334 |
| ROOH | PPB) | 0.004 | 0.099 | 0.386 | 0.974 | 1.614 | 2.167 | 2.587 |
| CRES | PPB) | 0.002 | 0.018 | 0.018 | 0.016 | 0.015 | 0.013 | 0.012 |
| DIAL | PPB) | 0.003 | 0.095 | 0.079 | 0.047 | 0.027 | 0.017 | 0.013 |
| MGLY | PPB) | 0.003 | 0.072 | 0.056 | 0.031 | 0.018 | 0.013 | 0.010 |
| HO2 | PPB) | 0.007 | 0.021 | 0.021 | 0.010 | 0.008 | 0.007 | 0.006 |
| RO2S | ug/m^3) | 0.010 | 0.042 | 0.107 | 0.189 | 0.207 | 0.202 | 0.183 |
| RO2L | ug/m^3) | 0.010 | 0.011 | 0.031 | 0.073 | 0.090 | 0.089 | 0.081 |
| RAO2 | ug/m^3) | 0.010 | 0.043 | 0.129 | 0.465 | 0.636 | 0.609 | 0.583 |
| NO2 | ug/m^3) | 0.010 | 0.000 | 0.001 | 0.006 | 0.008 | 0.008 | 0.008 |
| RCO3 | ug/m^3) | 0.010 | 0.012 | 0.061 | 0.301 | 0.335 | 0.325 | 0.271 |
| NH3 | PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

Run 31

SARMAP RUN 18 JULY 1984 (RUN A)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | PPB) | 2.231 | 2.219 | 2.177 | 2.161 | 2.150 | 2.140 | 2.133 |
| SO4 | ug/m^3) | 17.000 | 17.129 | 17.300 | 17.400 | 17.400 | 17.443 | 17.500 |
| NO | PPB) | 5.623 | 2.037 | 0.261 | 0.000 | 0.000 | 0.000 | 0.000 |
| NO2 | PPB) | 7.494 | 6.297 | 1.328 | 0.003 | 0.021 | 0.019 | 0.014 |
| O3 | PPB) | 37.514 | 61.343 | 88.043 | 84.214 | 89.486 | 88.057 | 87.043 |
| H2O2 | PPB) | 0.937 | 0.907 | 1.199 | 1.841 | 1.799 | 1.736 | 1.684 |
| HNO3 | PPB) | 0.362 | 2.174 | 3.279 | 3.356 | 3.346 | 3.337 | 3.331 |
| PAN1 | PPB) | 0.002 | 1.919 | 5.440 | 6.586 | 6.564 | 6.594 | 6.634 |
| PAN2 | PPB) | 0.002 | 0.400 | 1.463 | 1.880 | 1.901 | 1.897 | 1.879 |
| C3H8 | PPB) | 2.813 | 2.760 | 2.700 | 2.676 | 2.661 | 2.646 | 2.633 |
| ALKA | PPB) | 69.171 | 65.214 | 60.771 | 59.043 | 57.943 | 56.986 | 56.229 |
| ETHE | PPB) | 1.874 | 1.609 | 1.334 | 1.230 | 1.161 | 1.103 | 1.056 |
| ALKE | PPB) | 4.313 | 2.187 | 0.889 | 0.467 | 0.267 | 0.155 | 0.094 |
| AROM | PPB) | 9.751 | 7.544 | 5.529 | 4.874 | 4.493 | 4.174 | 3.941 |
| HCHO | PPB) | 6.561 | 7.963 | 7.976 | 5.990 | 4.310 | 3.200 | 2.483 |
| ALD2 | PPB) | 7.687 | 10.571 | 11.929 | 11.343 | 10.340 | 9.489 | 8.893 |
| KET | PPB) | 17.614 | 18.914 | 20.329 | 20.457 | 20.229 | 20.029 | 19.843 |
| HCNO | PPB) | 0.005 | 0.053 | 0.011 | 0.000 | 0.000 | 0.000 | 0.000 |
| RNO3 | PPB) | 0.002 | 0.808 | 1.703 | 1.881 | 1.870 | 1.857 | 1.847 |
| ROOH | PPB) | 0.004 | 0.015 | 0.217 | 2.156 | 4.384 | 6.339 | 7.513 |
| CRES | PPB) | 0.002 | 0.235 | 0.277 | 0.274 | 0.272 | 0.266 | 0.261 |
| DIAL | PPB) | 0.003 | 1.271 | 1.579 | 1.122 | 0.707 | 0.457 | 0.312 |
| MGLY | PPB) | 0.003 | 0.901 | 1.106 | 0.676 | 0.363 | 0.209 | 0.132 |
| HO2 | PPB) | 0.007 | 0.009 | 0.039 | 0.012 | 0.004 | 0.002 | 0.001 |
| RO2S | ug/m^3) | 0.010 | 0.017 | 0.086 | 0.459 | 0.511 | 0.496 | 0.461 |
| RO2L | ug/m^3) | 0.010 | 0.009 | 0.044 | 0.424 | 0.977 | 1.510 | 1.943 |
| RAO2 | ug/m^3) | 0.010 | 0.013 | 0.073 | 0.993 | 2.643 | 4.321 | 5.721 |
| KO2 | ug/m^3) | 0.010 | 0.001 | 0.004 | 0.052 | 0.140 | 0.231 | 0.306 |
| RCO3 | ug/m^3) | 0.010 | 0.006 | 0.037 | 2.010 | 4.659 | 6.706 | 8.297 |
| NH3 | PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

Run 32

SARNIA RUN 18 JULY 1984 (RUN B)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | PPB) | 2.251 | 2.223 | 2.187 | 2.137 | 2.107 | 2.090 | 2.080 |
| SO4 | ug/m^3) | 17.000 | 17.100 | 17.257 | 17.443 | 17.600 | 17.643 | 17.700 |
| NO | PPB) | 8.443 | 4.866 | 2.421 | 0.623 | 0.025 | 0.001 | 0.000 |
| NO2 | PPB) | 11.237 | 11.119 | 7.867 | 3.103 | 0.206 | 0.031 | 0.027 |
| O3 | PPB) | 37.514 | 50.586 | 71.471 | 94.571 | 104.286 | 103.414 | 102.386 |
| H2O2 | PPB) | 0.937 | 0.894 | 0.852 | 0.916 | 1.517 | 1.606 | 1.539 |
| HNO3 | PPB) | 0.562 | 2.520 | 4.676 | 6.616 | 6.996 | 6.983 | 6.969 |
| PAN1 | PPB) | 0.002 | 0.998 | 3.096 | 6.299 | 8.494 | 8.667 | 8.719 |
| PAN2 | PPB) | 0.002 | 0.191 | 0.808 | 1.716 | 2.293 | 2.333 | 2.319 |
| C3H8 | PPB) | 2.063 | 2.030 | 1.990 | 1.937 | 1.901 | 1.883 | 1.871 |
| ALKA | PPB) | 51.957 | 49.643 | 46.414 | 42.571 | 40.114 | 39.014 | 38.229 |
| ETHE | PPB) | 1.406 | 1.247 | 1.046 | 0.835 | 0.710 | 0.656 | 0.616 |
| ALKE | PPB) | 3.186 | 1.834 | 0.823 | 0.289 | 0.113 | 0.057 | 0.030 |
| AROM | PPB) | 7.319 | 5.994 | 4.467 | 3.067 | 2.356 | 2.094 | 1.916 |
| HCHO | PPB) | 4.876 | 5.691 | 6.261 | 6.181 | 5.039 | 3.639 | 2.751 |
| ALD2 | PPB) | 5.726 | 7.579 | 8.816 | 9.203 | 8.751 | 7.786 | 7.060 |
| KET | PPB) | 13.214 | 13.957 | 15.014 | 16.200 | 16.757 | 16.629 | 16.443 |
| HONO | PPB) | 0.005 | 0.094 | 0.068 | 0.026 | 0.002 | 0.000 | 0.000 |
| RNO3 | PPB) | 0.002 | 0.475 | 1.140 | 1.891 | 2.264 | 2.266 | 2.250 |
| ROOH | PPB) | 0.004 | 0.005 | 0.011 | 0.078 | 0.972 | 2.873 | 4.280 |
| CRES | PPB) | 0.002 | 0.155 | 0.210 | 0.178 | 0.150 | 0.141 | 0.134 |
| DIAL | PPB) | 0.003 | 0.805 | 1.179 | 1.130 | 0.833 | 0.523 | 0.342 |
| MGLY | PPB) | 0.003 | 0.560 | 0.828 | 0.819 | 0.576 | 0.325 | 0.198 |
| HO2 | PPB) | 0.007 | 0.003 | 0.007 | 0.024 | 0.027 | 0.005 | 0.002 |
| RO2S | ug/m^3) | 0.010 | 0.005 | 0.011 | 0.043 | 0.265 | 0.436 | 0.423 |
| RO2L | ug/m^3) | 0.010 | 0.002 | 0.006 | 0.021 | 0.187 | 0.635 | 0.975 |
| RAO2 | ug/m^3) | 0.010 | 0.003 | 0.009 | 0.040 | 0.483 | 1.917 | 3.156 |
| KO2 | ug/m^3) | 0.010 | 0.000 | 0.000 | 0.002 | 0.030 | 0.124 | 0.206 |
| RCO3 | ug/m^3) | 0.010 | 0.002 | 0.005 | 0.021 | 0.753 | 3.196 | 4.824 |
| NH3 | PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

SARMAP RUN 18 JULY 1984 (RUN C)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | PPB) | 2.231 | 2.230 | 2.197 | 2.154 | 2.116 | 2.099 | 2.027 |
| SO4 | ug/m^3) | 17.000 | 17.100 | 17.214 | 17.386 | 17.543 | 17.600 | 17.671 |
| NO | PPB) | 11.229 | 7.096 | 3.904 | 1.491 | 0.200 | 0.001 | 0.001 |
| NO2 | PPB) | 16.807 | 16.371 | 12.929 | 7.096 | 1.482 | 0.031 | 0.035 |
| O3 | PPB) | 37.514 | 52.386 | 75.371 | 101.971 | 123.143 | 125.714 | 124.429 |
| HCO2 | PPB) | 0.937 | 0.896 | 0.852 | 0.839 | 1.239 | 1.700 | 1.673 |
| HNO3 | PPB) | 0.562 | 3.010 | 6.094 | 8.801 | 10.024 | 10.101 | 10.077 |
| PAN1 | PPB) | 0.002 | 1.143 | 3.489 | 7.107 | 11.043 | 12.186 | 12.214 |
| PAN2 | PPB) | 0.002 | 0.205 | 0.881 | 1.930 | 2.956 | 3.250 | 3.246 |
| C3H8 | PPB) | 2.813 | 2.780 | 2.730 | 2.669 | 2.607 | 2.581 | 2.563 |
| ALKA | PPB) | 69.171 | 66.543 | 62.900 | 58.486 | 54.357 | 52.557 | 51.586 |
| ETHE | PPB) | 1.874 | 1.691 | 1.459 | 1.201 | 0.987 | 0.896 | 0.843 |
| ALKE | PPB) | 4.313 | 2.603 | 1.253 | 0.477 | 0.160 | 0.069 | 0.033 |
| AROM | PPB) | 9.751 | 8.230 | 6.431 | 4.687 | 3.401 | 2.936 | 2.707 |
| HCHO | PPB) | 6.561 | 7.379 | 7.944 | 7.894 | 7.013 | 5.324 | 4.031 |
| ALD2 | PPB) | 7.687 | 9.941 | 11.571 | 12.229 | 12.129 | 11.186 | 10.209 |
| KET | PPB) | 17.614 | 18.457 | 19.600 | 20.986 | 22.171 | 22.271 | 22.043 |
| HONO | PPB) | 0.005 | 0.118 | 0.091 | 0.049 | 0.009 | 0.000 | 0.000 |
| RNO3 | PPB) | 0.002 | 0.543 | 1.306 | 2.214 | 2.983 | 3.131 | 3.111 |
| ROOH | PPB) | 0.004 | 0.004 | 0.008 | 0.029 | 0.388 | 2.173 | 4.021 |
| ORES | PPB) | 0.002 | 0.185 | 0.266 | 0.239 | 0.187 | 0.173 | 0.169 |
| DIAL | PPB) | 0.003 | 0.953 | 1.469 | 1.524 | 1.268 | 0.865 | 0.574 |
| MGLY | PPB) | 0.003 | 0.656 | 1.003 | 1.060 | 0.882 | 0.546 | 0.324 |
| HCL | PPB) | 0.007 | 0.002 | 0.005 | 0.013 | 0.036 | 0.013 | 0.003 |
| ROOS | ug/m^3) | 0.010 | 0.004 | 0.008 | 0.022 | 0.139 | 0.434 | 0.474 |
| ROOL | ug/m^3) | 0.010 | 0.002 | 0.004 | 0.011 | 0.068 | 0.468 | 0.918 |
| RAD2 | ug/m^3) | 0.010 | 0.003 | 0.006 | 0.020 | 0.150 | 1.351 | 2.861 |
| KOO | ug/m^3) | 0.010 | 0.000 | 0.000 | 0.001 | 0.009 | 0.087 | 0.186 |
| ROOT | ug/m^3) | 0.010 | 0.001 | 0.004 | 0.010 | 0.124 | 2.331 | 4.827 |
| NH3 | PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

SARNIA RUN 18 JULY 1984 (RUN D)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 2.231 | 2.231 | 2.203 | 2.167 | 2.126 | 2.077 | 2.039 |
| SO4 | (ug/m^3) | 17.000 | 17.100 | 17.200 | 17.329 | 17.514 | 17.686 | 17.886 |
| NO | (PPB) | 11.229 | 8.143 | 5.976 | 3.853 | 2.104 | 0.887 | 0.276 |
| NO2 | (PPB) | 14.786 | 15.271 | 13.400 | 10.697 | 7.404 | 4.089 | 1.697 |
| O3 | (PPB) | 37.514 | 42.900 | 53.000 | 65.571 | 79.586 | 93.486 | 103.429 |
| H2O2 | (PPB) | 1.879 | 1.794 | 1.701 | 1.600 | 1.506 | 1.451 | 1.584 |
| HNO3 | (PPB) | 0.562 | 2.514 | 5.081 | 7.853 | 10.343 | 12.086 | 12.886 |
| PAN1 | (PPB) | 0.002 | 0.465 | 1.336 | 2.633 | 4.327 | 6.306 | 7.987 |
| PAN2 | (PPB) | 0.002 | 0.080 | 0.329 | 0.717 | 1.164 | 1.580 | 1.859 |
| C3H8 | (PPB) | 1.407 | 1.391 | 1.370 | 1.344 | 1.311 | 1.274 | 1.246 |
| ALKA | (PPB) | 34.643 | 33.514 | 31.866 | 29.929 | 27.700 | 25.386 | 23.543 |
| ETHE | (PPB) | 0.937 | 0.857 | 0.753 | 0.638 | 0.522 | 0.416 | 0.341 |
| ALKE | (PPB) | 2.157 | 1.384 | 0.758 | 0.355 | 0.141 | 0.050 | 0.018 |
| AROM | (PPB) | 4.873 | 4.201 | 3.390 | 2.573 | 1.841 | 1.265 | 0.912 |
| HCHO | (PPB) | 3.281 | 3.634 | 3.994 | 4.211 | 4.261 | 4.156 | 3.844 |
| ALD2 | (PPB) | 3.846 | 4.870 | 5.659 | 6.079 | 6.171 | 6.049 | 5.823 |
| KET | (PPB) | 8.814 | 9.164 | 9.666 | 10.284 | 10.986 | 11.657 | 12.157 |
| HONO | (PPB) | 0.005 | 0.113 | 0.112 | 0.094 | 0.066 | 0.034 | 0.012 |
| RNO3 | (PPB) | 0.002 | 0.238 | 0.568 | 0.963 | 1.393 | 1.811 | 2.106 |
| ROOH | (PPB) | 0.004 | 0.004 | 0.004 | 0.006 | 0.010 | 0.034 | 0.189 |
| CRES | (PPB) | 0.002 | 0.085 | 0.134 | 0.137 | 0.111 | 0.078 | 0.056 |
| DIAL | (PPB) | 0.003 | 0.428 | 0.689 | 0.752 | 0.679 | 0.542 | 0.409 |
| MGLY | (PPB) | 0.003 | 0.292 | 0.464 | 0.516 | 0.482 | 0.401 | 0.306 |
| HO2 | (PPB) | 0.007 | 0.001 | 0.002 | 0.003 | 0.005 | 0.013 | 0.023 |
| RO2S | (ug/m^3) | 0.010 | 0.001 | 0.003 | 0.004 | 0.009 | 0.023 | 0.071 |
| RO2L | (ug/m^3) | 0.010 | 0.001 | 0.001 | 0.002 | 0.004 | 0.008 | 0.024 |
| RAO2 | (ug/m^3) | 0.010 | 0.001 | 0.002 | 0.003 | 0.007 | 0.020 | 0.063 |
| NO2 | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.005 |
| RCO3 | (ug/m^3) | 0.010 | 0.001 | 0.001 | 0.002 | 0.005 | 0.012 | 0.046 |
| NH3 | (PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | (ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

EARNIA RUN 16 JULY 1988 (RUN E)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 2.251 | 2.231 | 2.207 | 2.176 | 2.144 | 2.111 | 2.080 |
| SO4 | (ug/m^3) | 17.000 | 17.100 | 17.200 | 17.300 | 17.443 | 17.571 | 17.686 |
| NO | (PPB) | 6.561 | 6.401 | 5.740 | 4.859 | 3.941 | 3.106 | 2.433 |
| NO2 | (PPB) | 9.391 | 8.287 | 7.521 | 6.743 | 5.987 | 5.289 | 4.736 |
| O3 | (PPB) | 28.114 | 29.814 | 31.557 | 33.743 | 36.257 | 38.843 | 41.257 |
| H2O2 | (PPB) | 0.937 | 0.897 | 0.851 | 0.804 | 0.757 | 0.716 | 0.681 |
| HNO3 | (PPB) | 0.562 | 1.391 | 2.876 | 4.269 | 5.646 | 6.876 | 7.844 |
| PAN1 | (PPB) | 0.002 | 0.024 | 0.090 | 0.208 | 0.373 | 0.563 | 0.743 |
| PAN2 | (PPB) | 0.002 | 0.010 | 0.031 | 0.058 | 0.087 | 0.110 | 0.125 |
| C3H8 | (PPB) | 4.687 | 4.640 | 4.574 | 4.496 | 4.410 | 4.326 | 4.253 |
| ALKA | (PPB) | 12.114 | 11.686 | 11.200 | 10.586 | 9.983 | 9.391 | 8.891 |
| ETHE | (PPB) | 0.008 | 0.008 | 0.007 | 0.006 | 0.005 | 0.004 | 0.004 |
| ALKE | (PPB) | 0.094 | 0.064 | 0.039 | 0.022 | 0.012 | 0.006 | 0.004 |
| AROM | (PPB) | 0.563 | 0.488 | 0.400 | 0.316 | 0.243 | 0.187 | 0.148 |
| HCHO | (PPB) | 0.939 | 0.803 | 0.770 | 0.823 | 0.919 | 1.017 | 1.090 |
| ALD2 | (PPB) | 0.005 | 0.373 | 0.759 | 1.097 | 1.354 | 1.527 | 1.624 |
| KET | (PPB) | 0.003 | 0.183 | 0.418 | 0.684 | 0.959 | 1.217 | 1.427 |
| HONO | (PPB) | 0.005 | 0.081 | 0.091 | 0.092 | 0.084 | 0.070 | 0.052 |
| RNO3 | (PPB) | 0.002 | 0.081 | 0.183 | 0.297 | 0.412 | 0.517 | 0.601 |
| ROOH | (PPB) | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| CRES | (PPB) | 0.002 | 0.011 | 0.016 | 0.018 | 0.016 | 0.013 | 0.011 |
| DIAL | (PPB) | 0.003 | 0.051 | 0.078 | 0.085 | 0.079 | 0.067 | 0.055 |
| MGLY | (PPB) | 0.003 | 0.033 | 0.052 | 0.057 | 0.054 | 0.047 | 0.039 |
| HCl | (PPB) | 0.007 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 |
| RD2S | (ug/m^3) | 0.010 | 0.000 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 |
| RD2L | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| RAD2 | (ug/m^3) | 0.010 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| AD2 | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| RDD3 | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 |
| NH3 | (PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | (ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

BERNIA RUN 18 JULY 1987 (RUN F)

| | | 10:00 | 11:00 | 12:00 | 13:00 | 14.00 | 15:00 | 16:00 |
|---|---|---|---|---|---|---|---|---|
| SO2 | (PPB) | 2.251 | 2.241 | 2.230 | 2.219 | 2.199 | 2.186 | 2.176 |
| SO4 | (ug/m^3) | 17.000 | 17.000 | 17.100 | 17.143 | 17.200 | 17.257 | 17.314 |
| NO | (PPB) | 11.229 | 12.629 | 12.314 | 11.829 | 11.214 | 10.557 | 9.857 |
| NO2 | (PPB) | 18.743 | 16.157 | 15.114 | 14.129 | 13.371 | 12.857 | 12.700 |
| O3 | (PPB) | 28.114 | 29.800 | 29.614 | 29.243 | 28.800 | 28.486 | 28.114 |
| H2O2 | (PPB) | 0.937 | 0.903 | 0.866 | 0.829 | 0.793 | 0.762 | 0.737 |
| HNO3 | (PPB) | 0.562 | 1.659 | 2.980 | 4.359 | 5.669 | 6.806 | 7.691 |
| PAN1 | (PPB) | 0.002 | 0.008 | 0.020 | 0.037 | 0.058 | 0.079 | 0.096 |
| PAN2 | (PPB) | 0.002 | 0.004 | 0.009 | 0.015 | 0.021 | 0.026 | 0.029 |
| C3H6 | (PPB) | 2.344 | 2.331 | 2.314 | 2.296 | 2.279 | 2.260 | 2.246 |
| ALKA | (PPB) | 6.093 | 5.989 | 5.851 | 5.704 | 5.559 | 5.431 | 5.330 |
| ETHE | (PPB) | 0.008 | 0.008 | 0.008 | 0.007 | 0.007 | 0.006 | 0.006 |
| ALKE | (PPB) | 0.047 | 0.036 | 0.026 | 0.019 | 0.013 | 0.010 | 0.007 |
| AROM | (PPB) | 0.282 | 0.261 | 0.236 | 0.211 | 0.189 | 0.170 | 0.158 |
| HCHO | (PPB) | 0.469 | 0.401 | 0.361 | 0.348 | 0.349 | 0.354 | 0.355 |
| ALD2 | (PPB) | 0.005 | 0.113 | 0.230 | 0.340 | 0.434 | 0.503 | 0.555 |
| KET | (PPB) | 0.003 | 0.052 | 0.114 | 0.180 | 0.245 | 0.301 | 0.344 |
| HONO | (PPB) | 0.005 | 0.087 | 0.100 | 0.105 | 0.101 | 0.089 | 0.072 |
| RNO3 | (PPB) | 0.002 | 0.024 | 0.051 | 0.080 | 0.109 | 0.133 | 0.152 |
| ROOH | (PPB) | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| CRES | (PPB) | 0.002 | 0.004 | 0.007 | 0.008 | 0.009 | 0.009 | 0.009 |
| DIAL | (PPB) | 0.003 | 0.017 | 0.026 | 0.031 | 0.033 | 0.032 | 0.029 |
| MGLY | (PPB) | 0.003 | 0.012 | 0.017 | 0.019 | 0.019 | 0.018 | 0.016 |
| PCO | (PPB) | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| RO2S | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| RO2L | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| RNO2 | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| HO2 | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| RCO3 | (ug/m^3) | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| NH3 | (PPB) | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| DUST | (ug/m^3) | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 |

ROX TELECOPIER 295 ; 4-19-89;10:38 PM; 4163234643 → 416965831 ; # 3

Ontario

# news release

Ministry
of the
Environment

April 21, 1989

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## COMPUTER MODEL ESTIMATES NITROGEN OXIDES REDUCTIONS MOST IMPORTANT TO REDUCE GROUND LEVEL OZONE

Reducing emissions of nitrogen oxide (NOx) is more effective than cutting hydrocarbon (HC) emissions to reduce ground level ozone concentrations, according to a computer model study released today by the Minister of the Environment.

The study, which incorporated data collected in the Sarnia area, showed that a reduction in either NOx or HCs would help to reduce ozone.

Ozone is produced when NOx and HCs react in the presence of sunlight. Both pollutants are emitted by industrial sources, such as power plants and factories, and by automobiles. Earlier studies have shown that more than 50 per cent of ozone in southern Ontario originates from U.S. sources.

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On days when the air is relatively unpolluted, the computer model predicted that a 50 per cent reduction in NOx results in a 12 per cent decline in ozone concentrations. When HCs are reduced by 50 per cent, ozone levels decline by eight per cent, according to the model.

On days when the air is polluted, a 50 per cent reduction in NOx also causes a 12 per cent decline in ozone while a 50 per cent reduction in HCs results in only a six per cent decrease in ozone levels, the model estimated.

Ozone levels would decline by a relatively small margin compared with the local reduction in HC or NOx ~~levels~~ emissions because large amounts of ozone are imported from other regions. The report says that if NOx and HC emissions were reduced significantly only in the Sarnia-Windsor area, high ozone levels would persist because of the long-range transport of ozone, HC and NOx from the U.S.

Copies of the report, Modelling of Ozone Production in the Sarnia Region, are available by calling (416) 323-4321.

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